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GEOLOGICAL SURVEY OF CANADA
GEORGE M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY

OTTAWA
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Each of the sheets of previous parts of this volume bears, at its foot, the imprint of a date at which an edition of 100 advance copies, without plates, was distributed to palæontologists and scientific publications.

Part I, complete, consisting of pages 1-90, with plates 1-11, (in each case, both inclusive) was published in 1885; Part II, of pages 91-196, with plates 12-26, in 1889; Part III, of pages 197-254, with plates 27-32, in 1891; and Part IV, of pages 255-360, with plates 33-47, in 1892.

The Part now submitted (Part V) which concludes the volume and consists of pages 361-436, with plates 48-50 and five woodcuts, will bear date herewith.

GEORGE M. DAWSON.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, November, 1898.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, LL.D., F.R.S., DIRECTOR.

3

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME I.

—BY—

J. F. WHITEAVES, F.G.S., F.R.C.S., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART I.—Report on the Invertebrata of the Laramie and Cretaceous Rocks of the Vicinity of the Bow and Belly Rivers and adjacent localities in the North-West Territory.

PRINTED FOR THE GOVERNMENT OF CANADA.

DAWSON BROTHERS, PUBLISHERS,
MONTREAL.
1885.

Under the general title of "Contributions to Canadian Palæontology" it is proposed to publish, from time to time, such papers as cannot be conveniently included in either of the volumes on the Palæozoic or Mesozoic Fossils of Canada now in course of preparation. These papers and the plates which illustrate them will be paged and numbered consecutively, and an index will be prepared for each volume as soon as completed.

The part now presented contains a descriptive report on the fossils collected by Dr. G. M. Dawson and other officers of the Survey in the years 1881–84, both inclusive, from the Laramie and Cretaceous rocks of the Bow and Belly River district. It consists of eighty-nine pages of letterpress, illustrated by eleven lithographic plates.

ALFRED R. C. SELWYN.

Geological and Natural History Survey Office,
Ottawa, 4th Aug., 1885.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

5

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

1. *Report on the Invertebrata of the Laramie and Cretaceous rocks of the vicinity of the Bow and Belly Rivers and adjacent localities in the North-West Territory.*

The present paper is intended primarily as a palæontological supplement or appendix to Dr. G. M. Dawson's "Report on the Region in the Vicinity of the Bow and Belly Rivers," published in 1885 in the "Report of Progress" of the Survey for 1882-83-84. It is mainly based upon collections made by Dr. Dawson and Messrs. R. G. McConnell, J. B. Tyrrell and T. C. Weston in the years 1881-84, but in order to make it as complete a presentation as possible of the present state of our knowledge of the invertebrate fauna of the Laramie and Cretaceous rocks of the Canadian North-West, it contains also a revision of the species from these formations obtained by Dr. Dawson in 1874 in his capacity of Geologist to H. M. North American Boundary Commission, and identifications of a few Cretaceous fossils collected by Prof. Macoun in 1879.

Dr. Dawson's Report, in the volume referred to, contains several short lists of fossils, but these as there stated "are to be regarded as provisional only," and may be considered as superseded by the present paper.

The species are enumerated or described, as the case may be, in a stratigraphical and descending order corresponding as nearly as possible to the grouping and nomenclature in Dr. Dawson's Report. The only exceptions to this mode of arrangement occur in the case of a few of the specimens from the Laramie basin north of the typical region near the Belly River. In this northern part of the basin it has so far been impossible to correlate the sub-divisions of the Laramie with those of the Belly River and vicinity.

The writer desires to acknowledge his obligations to Dr. C. A. White, of the Smithsonian Institute, Washington, for a direct comparison of a number of Canadian specimens with the types of several of his own and of Mr. Meek's species in the museum of that institution, and for various and valuable critical suggestions.

A. FROM THE WESTERN LARAMIE.

(1.) From the Porcupine Hill Series.

No fossils have yet been obtained from the Porcupine Hill Series proper, though it is probable that a systematic search would result in the discovery of fossiliferous beds. In the sandstones and shales of Shaganappie Point, two miles west of Calgary, however, Sir William Dawson collected a few remains of the shells of fresh water mollusca in 1883. The deposits at this place are on the horizon of those of the Porcupine Hill Series of the southern part of the district, though for reasons which will be stated more at length in connection with the St. Mary R. Series, the definition of the sub-divisions of the Laramie has not been attempted on the northern part of the map which accompanies Dr. Dawson's report. The genera or species indicated at this locality appear to be somewhat as follows, so far as they can be ascertained:—Three detached valves of a *Sphærium* or *Leptesthes*, the largest of which may be conspecific with the *Sphærium recticardinale* of Meek & Hayden, but the characters of the interior of all three are unknown: fragments of a *Physa*, probably of that form of *P. Copei*, White, which will be described and figured in the present paper as the variety *Canadensis*; casts of the interior of the shell of a *Goniobasis* (?); *Viviparus Leai*, Meek & Hayden; and a single specimen of a shell which is either an unusually large form of a new species of *Valvata* which will be found described a little farther on under the name of *V. filosa*, or a species of *Patula*.

(2.) From the Willow Creek Series.

In the clays, sandstones and indurated sands of this sub-division of the Western Laramie, fossils appear to be scarce and are usually not well preserved. The only localities at which any were collected are on the Upper Belly River seven miles above the mouth of the Old Man River, and on the Upper Belly River near Slide Out, by Mr. R. G. McConnell in 1881. The species from the locality first mentioned are—an apparently new species of *Unio*; fragments of a small bivalve perhaps referable to the genus *Sphærium*; crushed examples of a new species of *Patula*, which will be described a little farther on, under the name *P. obtusata*, from much better specimens collected from the "St. Mary River Series" on the Old Man River; and a few badly preserved casts of a *Goniobasis*, which is probably only a variety of the *G. tenuicarinata* of Meek and Hayden. On the Upper Belly River near Slide

Out the only fossils collected are a few casts of a *Unio* which are not sufficiently perfect to be identified. A few fragments of Unios and other fresh water shells were noticed at some other localities, but no specimens were collected.

The supposed new species of *Unio* from near the mouth of the Old Man River may be described as follows :

UNIO ALBERTENSIS. (N. Sp.)

Plate 1, fig. 1.

Shell very inequilateral, strongly compressed at the sides and thickest near the mid-length, so that the outline of the closed valves as seen from above is regularly lanceolate: lateral outline transversely subelliptical: length about twice the maximum height: height almost exactly twice the greatest thickness. Anterior and posterior extremities both rounded at the margin, and of nearly equal breadth : anterior side very short: posterior side considerably elongated, about three times as long as the anterior : ventral margin and superior border almost straight and nearly parallel for the greater part of their length,—the former rounding upwards obliquely and rather abruptly, and the latter sloping downwards in an equally abrupt and obliquely convex curve, at each end. Beaks very small and inconspicuous, placed about half way between the centre and the anterior termination of the valves.

Surface concentrically striated : test rather thin : characters of the interior unknown.

Length, seventy millimetres : maximum height, thirty-six mm.: greatest thickness, eighteen mm.

Upper Belly River, Alberta, N. W. T., seven miles above the mouth of the Old Man River, R. G. McConnell, 1881 : one nearly perfect specimen with the test preserved on both valves and entirely free from the matrix.

(3.) FROM THE ST. MARY RIVER SERIES AND LOWER PORTION OF THE LARAMIE GENERALLY.

In the southern portion of the district included in the geologically-coloured map of the region in the vicinity of the Bow and Belly Rivers, the Laramie, on lithological grounds, is clearly separable into three subdivisions, as described in Dr. G. M. Dawson's report already referred to. In the district embraced by the northern part of the map it has been found difficult to carry out a similar lithological subdivision of the formation, and no attempt has been made to indicate such subdivisions on the map. Still further northward, in the district from which the greater number of the fossils collected by Mr. J. B. Tyrrell were obtained, it becomes quite impossible to distinguish the three subdivisions above referred to. The mollusca from this district, however, are for the most part from the lower portion of the Laramie, and consequently from a horizon nearly or quite equivalent to that occupied in the typical region by the St. Mary River Series. In the present paper, under the heading A. of the "Western Laramie" and in section 3, the species collected from the St. Mary River Series proper will be separately designated as such. The remainder are from the lower portion of the Laramie in its northern extension, with the exception of six species from the same northern region, which occupy positions so far up in the Laramie that the beds in which they occur may possibly represent the Willow Creek or Porcupine Hill Series. These again will be specially designated, though they are included in the present section for convenience of description. With the exception of these last-mentioned species, the mollusca here described or enumerated in section 3 of subdivision A may be considered as representing the fauna of the lower part of the Laramie of the region.

LAMELLIBRANCHIATA.

ANOMIA PERSTRIGOSA. (N. Sp.)

Plate 1, fig. 2.

Upper valve (assuming that the shell is an *Anomia*) moderately convex, irregular in outline, and varying from subcircular to obliquely subovate, sometimes slightly arcuate and curved to the left. Beaks marginal, small, but in some specimens rather prominent.

Surface marked by radiating raised lines, a few of which, at distant but irregular intervals, are conspicuously broader and more prominent than the rest. Under an ordinary simple lens, these radiating lines are seen to be subnodulous, in consequence of their passing over the faint concentric lines of growth. Under valve and characters of the interior of the upper unknown.

Upper Belly River, twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; St. Mary River Series: three specimens.

The muscular impressions and hinge dentition of this shell being unknown, it is, of course, not quite certain whether it is an *Anomia* or not. Dr. C. A. White, who has seen the specimens, thinks it is a *Placunanomia*, of the subgenus *Monia*, Gray.

OSTREA GLABRA, Meek and Hayden.

Ostrea glabra, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 146.
Ostrea Wyomingensis, Meek. 1873. Rep. U. S. Geol. Surv. Terr. for 1872, p. 508. Illustrated by Dr. C. A. White on pl. 20 of Contr. to Pal. (U.S. Geol. Surv., 1880), Nos. 2 to 8.
Ostrea arcuatilis, Meek. 1873. Rep. U.S. Geol. Surv. Terr. for 1872, p. 477.
Ostrea glabra, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 509, pl. 40, figs. 2, a, b, c, d.
Ostrea insecuris, White. 1876. Powell's Rep. Geol. Uinta Mts., p. 112. Illustrated on pl. 21 of Dr. C. A. White's Contr. to Pal., Nos. 2 to 8.
Ostrea glabra, White. (as of M. & H.) 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2 to 8, p. 56.
Ostrea glabra, White. (as of M. & H.) 1883. Rev. Non-Marine Foss. Moll. N. Am., pls. 9, 10, 11 and 12.

Bow River, mouth of East Arrow-wood Creek, G. M. Dawson, 1881: Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; St. Mary River Series. High River five miles above the forks, R. G. McConnell, 1882: Forks of Devil's Pine and Three Hills Creeks, also Red Deer River, near 8th correction line, J. B. Tyrrell, 1884. Oyster Creek, N. W. branch of the north fork of the Old Man River, G. M. Dawson, 1884. This last locality is in a nearly isolated basin in the mountains, and the horizon is not certainly that of the St. Mary River Series.

Most of the specimens from these localities belong to the variety *Wyomingensis*.

A single valve of an oyster collected by Prof. Macoun from a layer of limestone in the Hand Hills, in Township 28, Range 17, west of the 4th Meridian, may also be referable to this variable species.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. (as of E. & S.) 1876. Rep. U.S. Geol. Surv. Terr., vol, IX., Rep. Inv. Cret. & Tert. Foss. U. Miss. Cy., p. 510. pl. 40, figs. a, b, c, d.
" " White. 1883. Rev. Non-marine Foss. Moll. N. Am., pl. 12, figs. 2–5.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881, and T. C. Weston, 1883, not uncommon ; in basal beds of St. Mary River Series. Upper Belly River, twenty-two miles above the mouth of the Waterton, R. G. McConnell, 1881 ; St. Mary River Series : one valve.

Perhaps a variety of the preceding species, as suggested by Dr. C. A. White.

UNIO DANÆ, Meek and Hayden.

Unio Danæ, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX, p. 145.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 517, pl. 41, figs. 13, a, b, c.

Bow River, mouth of East Arrow-wood Creek (base of section), also Bow River, four and eight miles west of Blackfoot Crossing, G. M. Dawson, 1881 ; St. Mary River Series.

Belly River, west of crossing of MacLeod-Benton Trail, and Little Bow River, five miles below crossing of Blackfoot Trail, R. G. McConnell, 1881 ; St. Mary River Series.

Pincher Creek, T. C. Weston, 1883 ; St. Mary River Series. Knee Hills Creek, Township 29, Range 22, west of 4th Principal Meridian, J. B. Tyrrell, 1884.

In a conversation with the writer, Dr. C. A. White expressed the opinion that the *Unio Danæ*, *U. subspatulatus* and *U. Deweyanus* of Meek & Hayden are all varietal forms of one species, and it is upon this hypothesis that the fossils from the above mentioned localities are all referred to *U. Danæ*. Some of these specimens from the Canadian North-west are fairly typical representatives of the *U. Danæ*; some again are more like *U. subspatulatus*, while others possess characters apparently intermediate between these two varieties or nominal species.

UNIO SENECTUS, White.

Unio senectus, White. 1877. Bull. U.S. Geol. Surv. Terr., vol. III., p. 600.
" " " 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 69, pl. 28, figs. 1 a, b, c.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 19 figs. 1, 2.

Bow River, two miles below the mouth of Jumping Pound River, G. M. Dawson, 1881 : three imperfect but characteristic casts, two of which have been sent to the author of the species, who confirms the correctness of their identification.

CORBICULA CYTHERIFORMIS, Meek & Hayden.

Cyrena (*Corbicula ?*) *cytheriformis*, Meek & Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 176.
Corbicula cytheriformis, M. & H. *Ib.*, p. 432.
Corbicula cytheriformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, &c., p. 520, pl. 40. figs. 5 a, b, c, d, e.
" " White. 1880. U.S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 74, pl. 21, figs. 4 a, b, c, d.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 31. pl. 22, figs. 1-6.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883. From the basal beds of the St. Mary R. Series.

CORBICULA OCCIDENTALIS, Meek & Hayden.

Plate 1, figs. 3 & 3a.

Cyrena occidentalis, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII. p. 116.
Corbicula occidentalis, Meek. 1869. *Ib.*, vol. XII, p. 432.
Corbicula (*Veloritina*), *Bannisteri*, Meek. 1873. Rep. U.S. Geol. Surv. Terr. for 1872, p. 513.
Corbicula occidentalis, Meek & Hayden. G. M. Dawson. 1875. Rep. Geol. & Res. of Reg. in Vic. of 49th. Par., p. 133.
Corbicula occidentalis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 521, pl. 40, figs. 6a, b, c.
Corbicula occidentalis, White. (as of M. & H.) 1880. U.S. Geol. Sur. Terr. Contr. to Pal., Nos. 2-8, p. 75, pl. 21, figs. 3 a, b, c.
Corbicula occidentalis, White. (as of M. & H.) 1883. Rev. Non-Marine, Foss. Moll. N. Am., p. 31, pl. 17, figs. 6, 7 & pl. 23 figs. 1-6.

St. Mary River, two miles north of the 49th Parallel,—and four miles west of the St. Mary River; G. M. Dawson, 1874, H. M. North American Boundary Commission; St. Mary R. Series.

Bow River, mouth of East Arrow-wood Creek, (top of section) G. M. Dawson, 1881; Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883, very abundant. All St. Mary R. Series.

Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881; at both places probably from the St. Mary R. Series, but in a disturbed region.

Oyster Creek, N. W. branch of the north fork of the Old Man River ; G. M. Dawson, 1884. See note to same place under *Ostrea glabra*. Red Deer River, near the 8th correction line,—and forks of the Devil's Pine and Three Hills Creeks ; J. B. Tyrrell, 1884.

The specimens from these localities, which are somewhat variable in shape, appear to be nearly intermediate in their characters between *C. occidentalis* and *C. cytheriformis*, and it is doubtful to which of these species they should be referred. According to Meek, the shell of *C. occidentalis* is " subtrigonal in form, with height and length about equal," whereas that of *C. cytheriformis* is said to be "transversely ovate subtrigonal, or varying to sub-circular, but always a little longer than high." In the Canadian specimens, some of which are very perfect and measure fully one inch and three quarters in their two lateral diameters, the outline is distinctly subtrigonal and the height and length are either equal or else the height slightly exceeds the length. As compared also with the published figures of the two species, the specimens from the Canadian North-West are much more like those of *C. occidentalis* than those of *C. cytheriformis*.

CORBICULA OBLIQUA. (N. Sp.)

Plate 1, figs. 4, 4 a and 4 b.

Shell compressed convex, the thickness through the closed valves being about one-third less than the maximum height inclusive of the beaks : obliquely sub-ovate, usually a little longer than high and very inequilateral. Anterior side extremely short, its margin either slightly concave or vertically truncated under the beaks above, and rounding abruptly or declining rapidly and convexly into the ventral margin below : posterior side moderately elongated, obtusely pointed at the base, its upper margin forming one continuous, obliquely convex curve which extends from the beaks to the base ; ventral margin semi-ovate. Beaks small, anterior and nearly or quite terminal, almost erect, their extreme apices only being curved inwards, forwards and a little downwards.

Surface concentrically striated : characters of the interior unknown.

Length of the most perfect specimen collected, twenty-six millimetres : maximum height of the same, twenty-two mm. : thickness through the closed valves, fifteen mm.

Rye-Grass flat, Old Man River, (one perfect specimen, with the test preserved on both valves) and Bow River, eight miles west of Blackfoot Crossing, (a well preserved cast of a left valve), G. M.

Dawson, 1881. Upper Belly River, twenty-two miles above the mouth of the Waterton, (two left valves), and Little Bow River, opposite the mouth of Snake Valley, (one right valve with the test preserved), R. G. McConnell, 1881. All from the St. Mary R. Series.

The lateral compression of the valves and their extreme obliquity, coupled with the small size and nearly terminal position of the beaks, seem to afford a ready means of distinguishing this shell from the *Corbicula occidentalis* of Meek and Hayden.

SPHÆRIUM RECTICARDINALE, Meek and Hayden.

Sphærium recticardinale, Meek and Hayden. 1860. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 176.

Sphærium recticardinale, Meek. 1876. Rep. U. Geol. Surv. Terr., vol. IX, p. 527, pl., 43, figs. 3, a, b.

Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881; St. Mary River Series: one nearly perfect specimen and seven single valves.

(CORBULA PERUNDATA, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 116.

Corbula perundata, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4, a, b, c, d.

South or First Branch of the Milk River, N. W. T., G. M. Dawson, 1874, H. M. American Boundary Commission: a few single valves from a loose piece of concretionary limestone.* According to Dr. C. A. White, *C. perundata* is only a variety of *C. subtrigonalis*, M. and H.)

CORBULA PERANGULATA. (N. Sp.)

Plate 1, figs. 5, 5 a and 5 b, and plate 2, fig. 1.

Shell compressed laterally, moderately convex, thickest a little in front of the middle and narrowing regularly as well as gradually to the posterior end but very abruptly so to the anterior, so that the outline of the closed valves as seen from above is ovately lanceolate.

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* These are the specimens referred to on page 37 C and in a foot note to page 126 C of Dr. Dawson's Report on the Bow and Belly River country published in 188

Anterior side very short, obliquely and convexly subtruncated at its extremity above and in the middle, but obtusely sub-angular below at its junction with the ventral margin: posterior side elongated and produced into a long and narrow pointed beak, which is either straight or curved slightly upwards and whose upper margin is strongly angulated. Ventral margin semi-ovate, very moderately convex, curving upwards somewhat more rapidly at the anterior than at the posterior end, but very gently at both, the posterior half being often nearly straight or even faintly concave: superior border descending abruptly and obliquely in front of the beaks and confluent with the margin of the anterior end in one unbroken line which descends obliquely from the beaks to the base,—descending gradually behind the beaks in either a straight line or with a shallowly concave curve to the upper termination of the posterior side: beaks obliquely flattened on all sides, placed in advance of the middle, that of the right valve curved inwards and downwards, that of the left erect but somewhat incurved and with a slight forward inclination. Posterior area large and very distinctly defined, flattened at a right angle to the valves and in some cases shallowly excavated, broadly lanceolate in outline as viewed from above, and bordered by the strong keel which also forms the upper margin of the beaked posterior extremity of each valve.

Surface marked with a few coarse and rather distant but irregularly disposed lines of growth, with much finer and close set concentric striæ between them. Test rather thick: hinge teeth as in *Corbula* proper, muscular impressions unknown.

Dimensions of a full sized and perfect specimen: length, forty millimetres: maximum height, twenty-five millimetres: thickness through the closed valves, nineteen millimetres. The maximum thickness of another specimen of the same length and height is only sixteen millimetres.

In young individuals the anterior end of the shell is regularly rounded, and the posterior area is not so much flattened down as it is in the young shell. The beaked posterior side is usually pointed at its extremity, but in some specimens there is a distinct truncation at its extreme tip.

Rye-Grass flat, Old Man River, G. M. Dawson, 1881 and T. C. Weston, 1883, extremely abundant. Upper Belly River, twenty-three miles above the mouth of the Waterton, and Scabby Butte, seven miles north of the confluence of the Belly and Old Man Rivers; R. G. McConnell, 1881. All from the St. Mary R. Series.

A very distinct species, apparently belonging to the same section of the genus as the *Corbula pyriformis* of Meek. Specimens of the latter shell from the Bear River Laramie of S. W. Wyoming, kindly forwarded by Dr. C. A. White for comparison, are distinctly pyriform in outline as viewed from above, the closed valves being very ventricose anteriorly,—the beaks of both valves are gibbous and curved strongly inwards, while the posterior area, though tolerably well defined is small and narrow. In *C. perangulata*, on the other hand, the outline as viewed from above is ovately lanceolate, both beaks are obliquely flattened and the posterior area is large and broad. The external aspect of *C. pyriformis*, as Mr. Meek has pointed out, is like that of a *Neæra*, whereas the outside of the present species has more the look of a *Leda*.

Dr. Dawson states that the beds characterized by a great abundance of this species, together with *Ostrea glabra, var. Wyomingensis* and *Corbicula occidentalis* (or *C. cytheriformis*) occur at the very base of the Laramie, and that these deposits may even be regarded as forming a passage between that formation and the summit of the marine Cretaceous. These beds are most characteristically developed in parts of the south western portion of the district embraced by the geological map before referred to, where they frequently occur in the disturbed strata of the foot-hill region. They have been recognized as far north as a few miles west of Blackfoot Crossing on the Bow River.

PANOPÆA SIMULATRIX. (N. Sp.)

Plate 2, figs. 2 and 2a.

Shell slightly inequivalve, the umbo of the right valve being a little larger and more tumid than that of the left: valves compressed at the sides, thickest on the anterior umbonal slopes and narrowing very gradually to the posterior end but more rapidly to the anterior: posterior termination gaping: lateral outline elliptic ovate, the length being fully twice the maximum height inclusive of the beaks, and the posterior side a little longer, narrower and more pointed than the anterior. Umbones broad, obtuse and depressed: beaks small, subcentral but placed a little in advance of the middle, that of the right valve curved inwards and downwards with a slight inclination forwards, that of the left valve curved inwards and a little forwards but not downwards: ligament apparently short and external.

Surface concentrically striated: inner layer of the test not nacreous: hinge teeth and muscular impressions unknown.

Length of the most perfect example collected, (the one figured) fifty-two millimetres: greatest height of the same, twenty-five mm.: thickness of the same, sixteen and a half.

The specimen from which the above description was made and which is therefore intended as the type of the species, was collected by Mr. J. B. Tyrrell in 1884 from the south bank of Knee Hills Creek, in Township 29, Range 22, west of the 4th Meridian.

Ten imperfect and badly preserved casts of shells which are probably referable to this species, were collected by Dr. G. M. Dawson in 1881, five at Rye-Grass flat on the Old Man River, and five at the mouth of East Arrow-wood Creek, on the Bow River; all from the St. Mary River Series. Mr. R. G. McConnell collected a similar cast on the Belly River, twenty-three miles above the mouth of the Waterton, in 1881. Some of the specimens collected by Dr. Dawson and Mr. McConnell, are broader in front and shorter than the type, and in others the beaks are placed much further forwards.

In referring these shells to the genus *Panopæa* rather than to *Anodonta* or *Unio* the writer has been influenced by the following considerations: first, that the valves gape at the posterior end; secondly, that they are slightly inequivalve, and lastly, that the inner layer of the test is not nacreous. The specific name is suggested by the close resemblance that the most perfect specimen presents to a narrow form of *Mya arenaria.*

PANOPÆA CURTA. (N. Sp,)

Plate 2, fig. 3.

Shell compressed laterally, about one-fourth longer than high, and nearly equilateral; posterior end gaping. Anterior side broad and about as long as the posterior, narrowing obliquely and convexly both above and below, and obtusely subangular or somewhat pointed a little below the middle; posterior side also broad, truncated almost vertically at its extremity in the right valve, but somewhat more rounded in the left. Ventral margin broadly and regularly rounded, most prominent in the middle; superior border descending rapidly and obliquely in front of the beaks, at first nearly straight and horizontal behind them, but ultimately forming an abruptly rounded junction with the outer margin of the posterior end above; beak of the right valve very nearly central, broad and moderately prominent, incurved, with a slight inclination forward; beak of the left valve a little smaller and more depressed.

Surface marked with rather coarse and irregularly disposed concentric striæ or lines of growth. Hinge teeth and muscular impressions unknown.

Length of the most perfect specimen known, forty-eight millimetres;

maximum height of the same, thirty seven; exact thickness not ascertainable.

Forks of Devil's Pine and Three Hills Creeks, J. B. Tyrrell, 1884: two specimens.

Perhaps only a broad and short variety of the preceding species. From the same locality Mr. Tyrrell collected seven specimens of a shell which may possibly represent a form intermediate between this and *P. simulatrix*, but they are so imperfect and badly preserved that it is impossible to state to what genus they should be referred.

GASTEROPODA.

LIMNÆA TENUICOSTATA, Meek and Hayden.

Limnæa tenuicostata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 119.
Limnæa (*Acella*) *tenuicostata*, M. and H. 1860. Ib., p. 431.
Limnæa (*Pleurolimnæa*) *tenuicostata*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 534, pl. 44, figs. 13, a, b, c.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian; J. B. Tyrrell, 1884; several characteristic but not very perfect specimens.

Mr. Tyrrell states that the fossils from this locality are from beds which are probably higher in the Laramie than those from which most of the other species here described under the heading A 3 were collected, but the precise relationship of these beds with the subdivisions adopted in the more southerly portion of the district has not yet been determined.

ACELLA. (Species undeterminable.)

A few fragments of an *Acella* were collected by Dr. G. M. Dawson in 1874 and 1881 from the North or Second Branch of the Milk River, in the St. Mary R. Series.

Dr. C. A. White, to whom these specimens were sent, regards them as distinct from his *A. Haldemani*, but they are too imperfect to admit of an accurate description of their characters.

PHYSA COPEI, White.

Plate 2, figs. 4 and 4a.

Physa Copei, White. 1877. Bul. U.S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 85, pl. 24, figs. 4a and b.
" " 1883. Rev. Non-Marine Foss. Moll., N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

Bow River, eight miles west of Blackfoot Crossing; Gooseberry Cañon, St. Mary River, and St. Mary River, three miles north of the 49th Parallel, G. M. Dawson, 1881. Pincher Creek, crossing of Mill Creek and Fort MacLeod Trail, G. M. Dawson and R. G. McConnell, 1881, and T. C. Weston, 1883. All from the St. Mary R. series.

High River, one mile below the Forks, R. G. McConnell, 1882.

Mouth of Blind Man River, J. B. Tyrrell, 1884; from the same geological horizon and from the same beds as *Limnæa tenuicostata.*

A few specimens of a large *Physa* were collected at the above-mentioned localities, which seem to correspond very well with Dr. White's descriptions and figures of *P. Copei*, especially in the character "spire short, less than one-third the entire length," and in the fact that the "diameter of the body volution is almost equal to one half the entire length of the shell. The number of volutions in *P. Copei* is indeed stated to be about four, but Dr. White's figures show that the apex as well as the outer lip of the type of that species are very imperfect. In unbroken Canadian specimens of the shell now under consideration the number of volutions is six or seven, but the three apical whorls are exceedingly slender and fragile, and consequently may have been broken off in Dr. White's specimens, as they most frequently are in those from the Bow and Belly River district. Seven of the most perfect specimens from Pincher Creek and one example from Gooseberry Cañon were sent to Dr. White for examination, who reports upon them as follows, in a letter to the writer: "These all seem to belong to *P. Copei.* I think that if they had reached the size of my type specimens the last whorl would have been proportionately larger than your specimens present."

PHYSA COPEI, var. CANADENSIS. (Var. Nov.)

Plate 2, figs. 5, 5 b and 5 a.

Shell large, attaining to a length of fully two inches, narrowly subovate or ovately subfusiform in outline: length rather more than twice the maximum breadth: outer whorl, as measured close to the aperture, a little longer than the spire. Volutions six or seven, the first three or four slender and increasing slowly in size, the two next, especially the last but one, increasing rapidly both in length and breadth, each being obliquely and very gently convex: suture well defined but not very deeply impressed: outer whorl moderately convex, about one-third longer than broad, and broadest a little above the middle. Aperture rather more than one half the entire length of the shell, a little more than twice as long as wide, narrowly subovate or semiovate, contracted and acutely angular above, broader and usually more rounded but in some specimens bluntly pointed below: outer lip thin and simple: columella bearing a narrow, prominent and oblique fold near its base, the fold in some specimens being bordered below with a rather deep groove: columellar callus broad and closely adherent, except at its extreme base, where it is slightly separated from the main body of the shell in such a way as to form a minute and narrow kind of umbilical chink or perforation.

Surface nearly smooth, marked only with the faint and somewhat distant lines of growth common to most species of this genus.

Length of a large and nearly perfect specimen, fifty-three millimetres: maximum breadth of the same, twenty-two mm.: length of body whorl, as measured close to the outer lip, thirty mm. In a slightly smaller specimen which shows the characters of the aperture better, the length of the aperture is twenty-five mm. and its maximum width only ten.

Pincher Creek, crossing of Mill Creek and Fort MacLeod Trail, very abundant, G. M. Dawson and R. G. McConnell, 1881, and T. C. Weston, 1883. Gooseberry Cañon, St. Mary River, frequent, G. M. Dawson, 1881: Second or North Branch of the Milk River, G. M. Dawson, 1881. All from the St. Mary R. Series.

During the past four years upwards of two hundred specimens of one or more species of *Physa*, whose relations to forms already described are extremely puzzling, have been collected by officers of the Survey in the Laramie Formation of the Canadian Northwest. Out of these specimens it is possible to select a few which have a large and long body whorl, and a very short acutely acuminate spire, and these cannot at present be distinguished from the *Physa Copei* of White.

By far the larger number, however, whose characters are more minutely described above, have a much longer spire, though it apparently never quite equals the outer whorl in length. Such specimens seem to be very nearly related to the *Bulinus disjunctus* of White, and have been doubtfully referred to that species in Dr. Dawson's report, though in *B. disjunctus* the length of the spire is said to be "a little more than half that of the whole shell." Thirty of the best specimens of this peculiar form, from Pincher Creek and Gooseberry Cañon, have been examined by Dr. White, who writes that he "cannot satisfactorily identify them with *B. disjunctus* nor with any other published species."

Still, these comparatively long-spired forms, and those with a short spire which have already been identified with *P. Copei* are connected by so many intermediate gradations that the writer is convinced that they cannot be separated specifically, and that the former can only be regarded as a well-marked but not very constant variety of the latter. The whole of the Physas that have so far been collected from the Canadian Laramie appear to the writer to belong to one variable species. If the identification of any of them with *P. Copei* be correct, the whole must be considered as varieties of that species, and if incorrect the whole of the specimens here described and figured may be designated simply as *P. Canadensis.* By whatever name they may be called, their extreme variability suggests the idea that *Bulinus disjunctus* and *B. atavus* of White may also prove to be varietal forms of *P. Copei.*

A unusually narrow form of the variety *Canadensis* occurs at Pincher Creek, in which the whorls are so much flattened laterally that the maximum breadth of the shell is considerably less than half its entire length. Such specimens as these, one of which is represented by figure 5a of Plate 2, approach very nearly in shape to *B. atavus*, and it is worthy of note that at Pincher Creek they occur associated with undoubted examples of *Viviparus prudentius*, White, as *B. atavus* does in the valley of Crow Creek in Northern Colorado.

Judging by the figure in Pictet's "Traite de Paléontologie," and by that in Zittel's "Handbuch der Paleontologie," *P. Copei, var Canadensis* seems to be rather nearly related to the *Physa nobilis* of Michaud, from the French Lower Eocene, but the original description and figures of that species are unfortunately not accessible to the present writer.

Dr. Paul Fischer* restricts the use of the name *Bulinus*, Adanson, to a group of shells with very convex whorls and an obtuse apex, and removes that genus from the family Physidæ on account of its different odontophore.. It is in accordance with this view and in spite of its close resemblance to *B. disjunctus* that the present shell is regarded as a *Physa* rather than a *Bulinus.*

*** Manuel de Conchyliologie. Vol. I. p. 509. Paris, 1881.**

ACROLOXUS RADIATULUS. (N. Sp.)

Plate 3, figs. 1 & 1a.

Shell depressed conical, very slightly elevated, the height being about one-fourth the maximum breadth: apex eccentric, inclined distinctly to the left and placed about half way between the centre and the posterior end: base, or margin of aperture, ovate in outline, not quite one-third longer than broad, rounded in front and somewhat pointed behind.

Surface marked by minute concentric lines of growth, which are crossed by numerous, closely disposed and almost equally minute radiating raised lines, both of which are too small to be seen without the use of a lens.

Length of the only specimen collected, five millimetres and a half: maximum breadth, four mm.: approximate height, from apex to base, about one mm.

Mouth of Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, J. B. Tyrrell, 1884. From the same geological horizon and from the same beds as *Limnæa tenuicostata.*

ACROLOXUS MINUTUS, Meek and Hayden.

Velletia minuta, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 120.
Ancylus (*Acroloxus*) *minutus*, M. & H. 1860. Ib., p. 432.
Acroloxus minutus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 543 pl. 44, fig. 10. Illustrated also in Dr. White's Rev. Non-Marine Foss. Moll. N. Am., pl. 24, fig. 27.

North or Second Branch of the Milk River, G. M. Dawson, 1874, H. M. North American Boundary Commission. Gooseberry Cañon, St. Mary River, and Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881. Pincher Creek, T. C. Weston, 1883. One or two specimens from each locality. All from the St. Mary R. Series.

The identification of these little shells with the species named above is not altogether satisfactory, first, on account of the vagueness of Mr. Meek's definition of the characters of *A. minutus*, and secondly, because of his statement that the specimens from the upper Missouri country, decribed under that name "may possibly belong to more than one species." Some of them may perhaps be referable to *A. radiatulus.*

PATULA ANGULIFERA. (N. Sp.)

Plate 2, figs. 6, 6 a, and 6 b.

Shell sublenticular, deeply umbilicated, periphery thin, angular and rather distinctly keeled : upper side very gently convex or very obtusely conical, nearly flat, the spire being raised only a little above the outer whorl. Volutions four, the first and second rounded above, the third and fourth flattened somewhat obliquely; lower side rather more convex than the upper, narrowing obliquely and somewhat convexly to the umbilical margin: umbilicus about one-third of the entire diameter of the base, deep, conical and obtusely subangular at its margin. Aperture trapezoidal, widest at a right angle to the axis of the shell, the columellar side being nearly parallel with the lower half of the outer lip, which latter is thin and simple.

Surface marked with minute and closely arranged striæ, which cross the whorls transversely, and which are arched forwards on the upper surface.

Maximum breadth of the only specimen collected, sixteen millimetres : height or depth of the same, as measured from the apex to the umbilical margin, eight mm.

Pincher Creek, T. C. Weston, 1883; St. Mary R. Series: a nearly perfect and tolerably well-preserved specimen.

This angulated and keeled shell seems to bear somewhat the same relations to the ordinary species with a rounded periphery that the recent *Patula Cumberlandiana* of Lea does to *P. alternata.*

PATULA OBTUSATA. (N. Sp.)

Plate 2, figs. 7, 7a and 7b.

Shell depressed, subdiscoidal, very moderately convex both above and below, the height being less than one half the greatest breadth : spire obtuse, nearly flat and raised but little above the highest level of the outer whorl. Volutions four to five, rounded, slender, and rather closely embracing, so that the upper surfaces only of those of the spire are exposed to view, except perhaps in the umbilical cavity : suture distinct but not very deep: outer whorl narrowly rounded at the periphery, moderately convex and retreating obliquely to the umbilical margin below : umbilicus about one-third the diameter of the base, deep and with steep sides, but with a rounded margin. Aperture (as seen in the few specimens collected, which may not be adult shells) apparently almost circular but shallowly emarginate on the columellar side by the encroachment of part of the last whorl but one: outer lip thin and simple.

Surface marked with fine transverse striations.

Greatest breadth of the largest specimen collected, thirteen millimetres: height of the same, five mm.; width of umbilicus of do., about four mm. and a half.

Old Man River, twelve miles below Fort MacLeod (two large specimens) and two miles above Rye-Grass flat, (five smaller ones) all collected by G. M. Dawson, in 1881, from the St. Mary R. Series. As already remarked on page 2, two specimens of this species were collected by R. G. McConnell in 1881, from the "Willow Creek Series" on the Belly River, seven miles above the mouth of the Old Man R.

There are so many points of resemblance between this species and the next that it is perhaps doubtful whether the shells described above are correctly referred to the genus *Patula.* They may be immature individuals of a new species of *Anchistoma.* In Dr. G. M. Dawson's report on the geology of the Bow and Belly River district, they are indicated under the name *Selenites,* by the present writer, on account of their supposed resemblance to the recent *Selenites concavus,* which is the *Helix concava* of Say.

ANCHISTOMA PARVULUM. (N. Sp.)

Plate 3, figs. 2, 2a & 2b.

Shell very small, subdiscoidal, nearly flat above and rather strongly convex below: volutions six, very slender, narrow and coiled on nearly the same plane, increasing very slowly in size and so closely embracing that the upper surfaces only of those of the spire are visible: first, second and third volutions about as much elevated as the outer whorl, the fourth and part of the fifth sunk to a slightly lower level: suture narrow, not very distinct: outer whorl flattened above and subangular at the periphery: umbilicus small but deep, about one-third or a little less than one-third of the entire basal diameter. Aperture exceedingly narrow and contracted, its outer margin, as viewed laterally, produced above into a small and narrowly rounded lobe next to the suture, and obliquely truncated below the middle, with an oblique constriction or narrow groove immediately behind the truncated portion. Characters of the interior of the aperture unknown.

Surface apparently almost smooth, but the surface markings are not well preserved.

Maximum breadth, four millimetres: height or depth, about two.

Old Man River, two miles above Rye-Grass flat, G. M. Dawson, 1881; St. Mary River Series.

The only specimen collected is a well preserved cast of the interior, with nearly all the test preserved except that which originally formed the outer margin of the aperture. In the cast this margin appears to be unbroken, but still it is possible that the specimen may not represent a fully adult shell. The species is referred to Klein's genus *Anchistoma* in the sense in which Stoliczka and Fischer use the word, also on account of its apparent generic affinities with the three species of *Anchistoma* described by Stoliczka in the "Cretaceous Gastropoda of Southern India," though it may be a small *Polygyra*. The upper portion of the aperture of the *A. Arrialoorense* of Stoliczka seems to be singularly like that of the present species.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden.

Plate 3, fig. 3.

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.
Bulimus Nebrascensis, Meek and Hayden. Ib.
Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 553, pl. 44, figs. 8, a, b, c, d.

Rosebud River, Township 27, Range 25, west of 4th Principal Meridian, one perfect and exquisitely preserved specimen, also, Three Hills Creek, Township 30, Range 23, west of 4th Meridian, a few examples associated with *Campeloma producta* White; at both localities collected by Mr. J. B. Tyrrell in 1884.

The dimensions of the specimen from the Rosebud River, which is of average size, are as follows: length, twenty-four millimetres: maximum breadth, nine mm.: length of last whorl, as measured near the aperture, twelve mm.

Although the specimens collected by Mr. Tyrrell are nearly twice the size of Meek's types and have a slightly more produced spire, they agree so closely in every other respect with the description and figures of *T. limnæiformis* that they are believed to be only a large local variety of that species.

MELANIA WYOMINGENSIS, MEEK.

Melania (*Goniobasis ?*) *Wyomingensis* Meek. 1873. Rep. U. S. Geol. Surv. for 1872, p. 516.
Melania larunda, White, 1876. Powell's Rep. Geol. Uinta Mts., p. 131.
Melania Wyomingensis, (Meek) White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 95, pl. 28, figs. 6a and b. Figured also on Pl. 26, figs. 1, 2 and 3 of Dr. White's Rev. Non-Marine Foss. N.A.

Upper Belly River, twenty-two and twenty-three miles above the mouth of the Waterton, R. G. McConnell, 1881: two characteristic specimens and two fragments. This species comes from the basal beds of the Laramie referred to in connection with the description of *Corbula perangulata*.

GONIOBASIS NEBRASCENSIS, Meek and Hayden.

Plate 3, figs. 4 and 4a.

Melania Nebrascensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 124.
Goniobasis Nebrascencis, M. and H. (White). 1875. Rep. Geogr. and Geol. Surv. W. of 100th Mer., Washington. p. 213, pl. 12, figs. 9a, b, c.
Goniobasis Nebrascensis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 565, pl. 43, figs. 12, a-h.
Goniobasis Nebrascensis, M and H. (White). 1883. Rev. Non Marine Moll. N. Am., p. 57, pl. 26, figs. 15 and 16.

Shell elongated, narrowly subovate, length a little more than twice the maximum breadth, spire about one-half the entire length, base imperforate. Volutions six or seven, those of the spire obliquely and very moderately convex or somewhat compressed laterally; suture not very distinct; outer whorl rather strongly convex in the middle, narrowing rapidly and unequally below. Aperture subovate, broader than long, angular above and narrowly rounded below; outer lip thin, simple, and with a shallow sinus above the middle.

Surface presenting a silky appearance to the naked eye, but, when examined with a lens, the sculpture is seen to consist of a minute and regular decussation caused by very minute and densely arranged transverse striæ, which are crossed by equally crowded and minute revolving lines.

Length of one of the most perfect specimens, twenty millimetres; maximum breadth of the same, eight millimetres; length of the outer volution, ten.

North or Second Branch of the Milk River ("nodular layer"), G. M. Dawson, 1874, H. M. North American Boundary Commission. Old Man River, two miles above Rye-Grass flat, and St. Mary River, three miles north of the 49th Parallel, G. M. Dawson, 1881. All from the St. Mary R. Series.

As the few Canadian specimens that have yet been collected seem to represent a rather peculiar variety of the species, an original description and a figure of one of the best preserved and most perfect specimens collected by Dr. Dawson is here given.

GONIOBASIS TENUICARINATA, Meek and Hayden.

Plate 3, figs. 5 and 5a.

Melania tenuicarinata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX, p. 137.

Goniobasis tenuicarinata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 566, pl. 43, figs. 14, a, b, c.

Bow River, two miles below the mouth of Jumping Pound River, G. M. Dawson, 1881; a few beautifully preserved specimens.

GONIOBASIS TENUICARINATA, Meek and Hayden, VAR.

Plate 3, figs. 6 and 6a.

Shell turreted, moderately elongated, the length being rather more than twice the maximum breadth; spire somewhat longer than the outer volution; base either imperforate or possibly with a very narrow fissure in place of the umbilicus. Volutions seven, the first, second, and third slender but rather ventricose, the three succeeding ones angulated and bearing a distinct narrow and prominent keel a little above the middle, their sides obliquely flattened above the keel and moderately convex or compressed in a direction nearly parallel to the axis below it; suture distinct. Outer whorl angulated and carinated considerably below the centre, strongly convex just below the keel, and narrowing gradually to the base. Aperture broadly subovate, pointed above and narrowly rounded below.

Sculpture consisting of numerous and very closely arranged minute revolving lines, which are too small to be visible to the naked eye, in addition to the spiral keel.

Length, twenty-one millimetres; maximum breadth, nine millimetres; length of outer volution, ten.

Two miles above Rye-Grass flat and twelve miles below Fort MacLeod on the Old Man River; also Gooseberry Cañon on the St. Mary River; G. M. Dawson, 1881. Pincher Creek, T. C. Weston, 1883. All from the St. Mary R. Series.

The specimens from the Bow River, which are here regarded as probably representing the most typical form of *G. tenuicarinata*, have convex and scarcely angulated whorls, the later ones of the spire being encircled with three or four rather distant, spiral raised lines, and the outer whorl by six or seven. Under a lens also, the surface of the volutions in this form is seen to be marked by crowded and minute transverse raised lines, at right angles to the spiral ones.

The shells from the localities indicated above seem to form a well-marked variety of *G. tenuicarinata*, which differs from the Bow River and more typical form in having the whorls always rather distinctly angulated above the middle, in the fact that the spiral raised lines are obsolete except the single raised line or minute keel upon the angle, and in the minute sculpture, which consists of exceedingly fine revolving impressed lines, instead of transverse raised striæ.

HYDROBIA.

A number of minute and slender fossil shells which appear to belong either to this or to some closely allied genus, were collected by G. M. Dawson at the North or Second Branch of the Milk River in 1874 and 1881; on the Old Man River, two miles above Rye-Grass flat, in 1881; and by Mr. T. C. Weston at Pincher Creek, in 1883; from the St. Mary R. Series. They rarely exceed three millimetres in length, and most of them are mere casts of the interior of the shell, though in some specimens the whole or part of the inner layer of the test is preserved. Some of them are considerably elongated and narrow in proportion to their length, and such specimens appear to be rather nearly related to the *Hydrobia recta* of White, though they are not quite so slender. Others again are comparatively shorter and more conical, and these are difficult to separate from the *H. Utahensis* of White and similar forms, but the whole of the specimens are too imperfectly preserved to be satisfactorily determined, and it is doubtful even how many species they represent.

CAMPELOMA PRODUCTA, White.

Campeloma (*Lioplax ?*) *producta*, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21-27.

Three Hills Creek, Township 30, Range 23, west of 4th Principal Meridian; J. B. Tyrrell, 1884: abundant.

Judging by Canadian specimens, this shell seems to the writer to be much more nearly related to some of the smooth N. American species of *Pleurocera*, such as *P. subulare*, Lea, *P. neglectum*, Anthony and others, than to the Viviparidæ.

VIVIPARUS PRUDENTIUS, White.

Viviparus prudentius, White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 98, pl. 28, figs. 5 a and b.

Viviparus prudentius, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 61, pl. 25, figs. 17,18.

Gooseberry Cañon, St. Mary River, G. M. Dawson, 1881, and Pincher Creek, T. C. Weston, 1883; from the St. Mary R. Series: rather common at both localities.

VIVIPARUS LEAI, Meek and Hayden.

Paludina Leai, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 121.

Vivipara Leai, Meek and Hayden. 1860. *Ib.* vol. XII., p. 185.

Viviparus Leai, Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 577, pl. 44, figs. 6, a, b, c, d.

Viviparus Leai, M. and H. White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 61, pl. 27, figs. 10-14.

Bow River, four miles west of Blackfoot crossing, abundant, and well preserved; St. Mary River, at Gooseberry Cañon, and three miles north of the 49th Parallel, common; Old Man River, two miles above Rye-Grass flat; G. M. Dawson, 1881. Belly River, twenty-three miles above the mouth of the Waterton; R. G. McConnell, 1881. Pincher Creek, T. C. Weston, 1883. All from the St. Mary R. Series.

Blind Man River, near 5th Principal Meridian, J. B. Tyrrell, 1884: from a slightly higher geological horizon than *Limnæa tenuicostata.*

VALVATA FILOSA. (N. Sp.)

Plate 3, figs. 7 and 7a.

Shell small, depressed turbinate, spire raised very little above the highest level of the outer whorl: volutions three, regularly rounded; suture distinct and deep: umbilicus rather less than one-third of the diameter of the base: aperture circular: outer lip thin and simple. Surface of the outer volutions marked by closely and regularly arranged, transverse and somewhat flexuous thread-like raised lines, which are too minute to be visible without the aid of a lens. Test very thin and fragile.

Maximum breadth, about three millimetres: height considerably less, but not ascertainable with much exactitude, all the specimens having either the upper or the under side buried in the matrix.

Pincher Creek, T. C. Weston, 1883, St. Mary R. Series: not uncommon, but with the delicate test rarely preserved.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, J. B. Tyrrell, 1884: from the same beds as *Limnœa tenuicostata.*

Some casts of a small *Valvata* from the North or Second Branch of the Milk River, which are referred to *Planorbis* or *Valvata subumbilicata* of Meek & Hayden, by Dr. G. M. Dawson, on page 131 of his "Report on the Geology and Resources of the Region in the vicinity of the 49th Parallel," are probably referable to this species.

This little shell appears to belong to a well-marked section of the genus, which has several tertiary as well as recent representatives, and which Fitzinger has proposed to separate under the name *Gyrorbis.* Its sculpture and shape are not unlike those of the *Valvata Leopoldi* of De Boissy, from the French Eocene, as figured by Pictet (Traite de Paléontologie, atlas, pl. 58, fig. 21), and Chenu (Manuel de Conchyliologie, vol. 1, fig. 2229), but the Canadian species has much the narrower umbilicus of the two.

Among recent shells *V. filosa* is very closely allied to the *V. striata* of Dr. Lewis, which is common in the Province of Quebec, and which in the writer's judgment, is quite distinct from the *V. sincera* of Say.

VALVATA BICINCTA. (N. Sp.)

Plate 3, figs. 8, 8a and 8b.

Shell depressed turbinate or subdiscoidal, spire raised very little above the highest level of the outer whorl in some specimens, its apex sunk a little below that level in others: outer whorl bicarinated or encircled by two narrow and minute but prominent thread-like spiral keels, one of which is placed on or about the middle of the upper surface, and the other around the umbilical margin. Volutions three or three and a half, those of the spire exposed only on the upper or posterior surface, the first and earliest part of the second regularly rounded in the middle; suture distinct and deep. Outer volution flattened above, with a downward inclination, on the inner side of the keel, rounded on its outer side and at the periphery: umbilicus deep, conical and about one-third the entire basal diameter. Aperture rounded in some specimens, somewhat rhomboidal in others, possibly from vertical compression, outer lip thin and simple.

Surface marked by minute, densely crowded and flexuous, transverse raised striæ, in addition to the spiral keels, but the former are too small to be made out without the use of a lens.

Maximum breadth, five millimetres: height not ascertainable with much accuracy, but evidently much less than the breadth.

Mouth of the Blind Man River, Township 39, Range 27, west of 4th Principal Meridian, rather abundant and associated with the preceding species. From the same geological horizon as *Limnæa tenuicostata.*

It is possible that *V. bicincta* may prove only a variety of *V. filosa,* but at present no intermediate forms have been collected.

B. FROM THE LARAMIE OF THE SOURIS RIVER DISTRICT.

(This is a northern extension of the Fort Union Laramie not at present proved to be stratigraphically continuous with the Western Laramie proper. The specimens here described from the Souris River are from localities in the immediate vicinity of the 49th Parallel near the intersection of the 103rd Meridian. See Geol. and Res. 49th Parallel, p. 86 *et seq.*, and Report of Progress Geol. Survey Can. 1879-80 p. 16 A.)

UNIO PRISCUS, Meek and Hayden.

Unio priscus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 117.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 516, pl. 43, figs. 8 a, b, c, d.

Wood End Depôt, Souris River, G. M. Dawson, 1874, H. M. North American Boundary Commission: five or six well preserved but very imperfect specimens, in which only the beaks and the anterior half of the test is preserved. Two casts of a *Unio* collected by Dr. Dawson at Pyramid Creek, in the same year and under the same auspices, may possibly also belong to this species.

CORBULA MACTRIFORMIS, Meek and Hayden.

Corbula mactriformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 117.
Corbula (*Potamomya*) *mactriformis*, M. & H. 1860. Ib. vol. XII., p. 432.
Corbula mactriformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 528, pl. 43, figs. 7, a-f.

Wood End Depôt, Souris River, G. M. Dawson, 1874, H. M. North American Boundary Commission: several perfect valves and a few fragments, associated in the same beds with *Unio priscus*.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden.

Plate 3, figs. 3a and 3b.

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.
Bulinus Nebrascensis, Meek and Hayden. Ib.
Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p 553, pl. 44, figs. 8, a, b, c, d.

Wood End Depôt, Souris River,—and Pyramid Creek, G. M. Dawson, 1874, H. M. North American Boundary Commission. Six specimens from the first named locality and one fragment from the second.

GONIOBASIS TENUICARINATA, Meek and Hayden.

Melania tenuicarinata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil. vol. IX., p. 137.
Goniobasis tenuicarinata, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 566, pl. 43, figs. 14, a b, c.

Pyramid Creek, G. M. Dawson, 1874, H. M. North American Boundary Commission, one specimen.

CAMPELOMA PRODUCTA, White.

Campeloma (Lioplax ?) producta, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21-27.

Wood End Depôt, Souris River, abundant, and "Great Valley," about one hundred miles west of Wood End, on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission. Short Creek, Souris River, A. R. C. Selwyn, 1880.

VIVIPARUS TROCHIFORMIS, Meek and Hayden.

Paludina trochiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 122
Vivipara trochiformis, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Viviparus trochiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 580, pl. 44, figs. 2 a-e.

Souris River, four miles east of Roché Percée, and Great Valley, about one hundred miles west of Wood End Depôt, on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission.

VIVIPARUS LEAI, Meek and Hayden.

Paludina Leai, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 121.
Vivipara Leai, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Viviparus Leai, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 577, pl. 44, figs. 6, a, b, c, d.

Souris River, four miles east of Roche Percée, G. M. Dawson, 1874, H. M. North American Boundary Commission. Short Creek, Souris River, A. R. C. Selwyn, 1880.

C. FROM THE "FOX HILLS" AND "FORT PIERRE" GROUPS OF THE UPPER CRETACEOUS.

The reasons for not considering the fossils from these two formations separately are thus given in the following memorandum prepared by Dr. Dawson. "In the district embraced by the geological map of the region in the vicinity of the Bow and Belly Rivers, published in the "Report of Progress" of the Canadian Survey for 1882-84, it is generally impossible to separate the Fox Hills and Fort Pierre series. In the map referred to, these series are consequently represented by a single colour. In a few places, generally situated in the south-western part of the district, the Fox Hills Group is clearly recognizable in the form of massive beds of sandstones, which on the St. Mary's River were observed to be about eighty feet in thickness. In other parts of the region the dark-bluish or coffee-coloured shales of the typical Fort Pierre Group become interbedded with sandstones, lose their dark colour, and pass imperceptibly upwards into the base of the Laramie. This is well seen in the vicinity of Rye-Grass flat, on the Old Man River. The change from marine to fresh water conditions, in these cases, occurs in this series of transitional beds, and when the fresh water character becomes pronounced, the fossils are found to be characteristically Laramie, to the exclusion of the marine Cretaceous forms of the underlying beds. When the Fox Hills Group is represented by massive sandstones, fossils of any kind are rarely present. Most of the fossils which form the subject of the present report have been collected in the district above defined, but the remarks above made with regard to the unsatisfactory character of the stratigraphical grounds for the separation of the Fox Hills and Fort Pierre Groups are generally equally applicable to the contiguous districts to the east and north, from which a portion of the fossil mollusca were derived."

BRACHIOPODA.

LINGULA NITIDA, Meek and Hayden.

Lingula nitida, Meek and Hayden. 1861. Proc. Ac. Nat. Sc. Phil., vol. XIII., p. 443.

" Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 9, pl. 28, figs. 18a, b.

Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway T. C. Weston, 1884; abundant: Old Wives Creek, Township 10, Range 11, west of third Principal Meridian, R. G. McConnell, 1884: one specimen.

LAMELLIBRANCHIATA.

OSTREA PATINA, Meek and Hayden.

Ostrea patina, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 277.
" " " G. M. Dawson, 1875, Rep. Geol. and Res. Reg. Vicin. 49th Parallel, p. 110.
Ostrea (? Gryphæa) patina, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 16, pl. 10, figs. 2a, b—a, b, bis, and 3 e–f, also pl. 11, varieties.

White Mud River (sometimes called Frenchman's Creek) near the 49th Parallel and south of Woody Mountain, G. M. Dawson, 1874, H.M. North American Boundary Commission: abundant and well preserved.

OSTREA INORNATA, Meek and Hayden.

Ostrea inornata, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 181.
" Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 14, pl. 10, fig. 4.

St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881: one perfect and apparently typical specimen.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. 1876. (But doubtfully as of E. and S.) Rep. U.S. Geol. Surv. Terr., vol. IX., p. 510, pl. 40, figs. 1a, b, c, d. Figured also on pl. 12, figs. 2–5, of Dr. C. A. White's Rev. Non-marine Foss. Moll. N. Am., Washington, 1883.

A number of valves of a small oyster which agree perfectly with Meek's description and figures of *O. subtrigonalis* were collected by G. M. Dawson in 1881 on the banks of the Belly River at the mouth of the St. Mary River, in rocks overlying the coal and occupying a position at the base of the shales of the Fort Pierre Group. Similar specimens were collected by Dr. Dawson in 1883 at Milk River Ridge in rocks of precisely the same geological horizon. The Belly River specimens are narrowly arcuate and more or less mytiloid in outline, while their lateral margins are usually but not always minutely crenulated. The lower valve is shallow, and either free or with a small scar of attachment, while the upper valve is flat.

CHLAMYS NEBRASCENSIS, Meek & Hayden.

Pecten Nebrascensis, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 87.
Chlamys Nebrascensis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol IX., p. 25, pl. 16, figs. 6, a, b, c.

East branch of the Poplar River on the 49th Parallel (the locality where the Woody Mountain Astronomical Station was established, *vide* page 107 of Dr. Dawson's Report on the Geology and Resources of the country in the vicinity of the 49th Parallel), G. M. Dawson, 1874, H. M. North American Boundary Commission : a perfect single valve whose outer surface is buried in the matrix.

Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884 : two single valves with the test almost entirely exfoliated.

PTERIA LINGUIFORMIS, Evans and Shumard. (Sp.)

Avicula linguiformis, Evans and Shumard. 1854. Proc. Ac. Nat. Sc. Phil., vol. II., p. 163.
" " Meek. 1859. Hinds' Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 6.
Pteria linguiformis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 32, pl. 16, figs. 1, a, b, c, d.

Elbow of South Saskatchewan, Prof. H. Youle Hind, 1858, Dr. R. Bell, 1873, and Prof. Macoun, 1879. South Saskatchewan, fifteen miles west of Swift Current Creek, R. G. McConnell, 1882, and Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884; abundant.

PTERIA (OXYTOMA) NEBRASCANA, Evans and Shumard.

Avicula Nebrascana, Evans and Shumard. 1857. Trans. Ac. Sc. St. Louis, vol. I., p. 38.
" " Meek. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 7.
Pteria (*Oxytoma*) *Nebrascana*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 34, pl. 16, figs. 3 a, b, and pl. 28, fig. 12.

"South Branch of the Saskatchewan," Prof. H. Y. Hind, 1858. South Saskatchewan opposite Swift Current Creek, R. G. McConnell, 1882.

PTERIA (PSEUDOPTERA) FIBROSA, Meek and Hayden, VAR.

Plate 4, fig. 1.

Avicula? fibrosa, Meek and Hayden, 1856. Proc. Ac. Nat. Sc. Phil., p. 86.
Pholadomya fibrosa, M. and H. 1856. Ib. 286.
Avicula (Pseudoptera) fibrosa, Meek. 1873. Sixth Rep. U.S. Geol. Surv. Terr., p. 489. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 36, pl. 17, figs. 17, a, b, c, d. Whitfield (as of M. and H.). Palæontology of the Black Hills of Dakota, p. 386, pl. 7, fig. 5.

Shell nearly equivalve, strongly compressed at the sides, obliquely sub-ovate and about one-third higher than long. Posterior margin sloping downwards and backwards in a broadly-convex, oblique curve from the posterior end of the hinge-line to the narrowly rounded base: anterior margin retreating obliquely backwards and downwards under the beaks, with a slightly and doubly sinuous outline in some specimens and a shallowly sigmoid one in others. Hinge-line short and straight: anterior and posterior wings quite obsolete: beaks small, anterior, terminal, curved inwards and forwards: posterior area large, broad, obliquely and sinuously flattened, bounded on each valve by a minute, narrow and moderately prominent plication, which extends from the posterior side of the beaks to the corresponding extremity of the basal margin.

Surface nearly smooth, but marked with a few, faint and distant, rounded concentric undulations. On the posterior area, too, in addition to the minute radiating fold which bounds it, there are two similar but distant radiating folds, which become obsolete towards the hinge near the outer margin of each valve, and between the innermost of these and the boundary of the area there is a short and not very deep radiating groove or narrow sinus, which also becomes obsolete towards the hinge line. Character of the interior of the valves unknown.

Length of the most perfect specimen, nineteen millimetres; height of the same, thirty-one mm.

Bow River, below Horse-Shoe Bend, G. M. Dawson, 1881: two well preserved and nearly perfect casts of the interior of the shell. These specimens differ from the typical form of *Pteria (Pseudoptera) fibrosa* in the much greater lateral compression of the valves, especially in the umbonal region, and in their nearly smooth surface. They can scarcely be considered, however, as indicating anything more than a local and rather well-marked variety of that species, of which it has been thought desirable to prepare an original description and a figure.

The distinction between *Pseudoptera*, Meek, and *Meleagrina*, Lamarck, is not very clearly defined, and it is possible and by no means improbable that the present species may be congeneric with the *Meleagrina antiqua* of the Chico group of California and with the *M. amygdaloidea* of the Middle Cretaceous of Skidegate Inlet in the Queen Charlotte Islands.

INOCERAMUS ALTUS, Meek.

Inoceramus altus, Meek. 1871. Dr. Hayden's Rep. U.S. Geol. Surv. Terr., p. 302.
" " " 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 43, pl. 14, figs. 1, a, b.
" " " Whitfield (as of Meek). Pal. Black Hills Dakota, p. 391, pl. 9, fig. 11.

East Fork of the Milk River, G. M. Dawson, 1874, H.M. North American Boundary Commission: a number of well-preserved but much distorted specimens, from a boulder. Most of these agree fairly with Mr. Meek's and Prof. Whitfield's descriptions and figures of *I. altus*, but one of them is strikingly like Prof. Whitfield's figure of a shell which he regards with doubt as possibly a variety of the *I. Vanuxemi* of Hall and Meek, on pl. 7, fig. 10, of the "Palæontology of the Black Hills of Dakota."

INOCERAMUS BARABINI, Morton.

Inoceramas Barabini, Morton. 1834. Synops. Org. Rem., p. 62, pl. 17, fig. 3 (pl. 13, fig. 11?).
Inoceramus gibbus, Tuomey. 1854. Proc. Ac. Nat. Sc. Phila., vol. VII., p. 170.
Inoceramus cuneatus, Meek and Hayden. 1860. Ib., 181.
Inoceramus Crippsii? var. *Barabini*, Morton. Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 49, pl. 13, figs. 1, a, b, c, and pl. 12. fig. 3.
Inoceramus Barabini, Whitfield. Pal. Black Hills Dakota, p. 398, pl. 7, fig. 7 and pl. 9, fig. 8.

Twelve miles east of White Mud River (or Frenchman's Creek), G. M. Dawson, 1874, H. M. North American Boundary Commission: seven specimens. Elbow of South Saskatchewan, Prof. J. Macoun, 1879: two good specimens and two imperfect ones.

INOCERAMUS SAGENSIS, var. NEBRASCENSIS, Owen.

Inoceramus Sagensis, Owen. 1852. Geol. Rep. Min., Iowa and Wiscons., p. 582, pl. 7, fig. 3.
Inoceramus Nebracensis, Owen. 1852. Ib., p. 582, pl. 8, fig. 1.
Inoceramus Sagensis, var. *Nebrascensis*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 52, pl. 13, figs. 2a, b.
Inoceramus Sagensis, Whitfield. Pal. Black Hills Dakota, p. 393,, pl. 7, fig. 12, and pl. 8, fig. 2.

St. Mary River, about ten miles from its mouth, G. M. Dawson, 1881: one rather large but imperfect specimen which closely resembles Owen's figure of the type of *I. Sagensis*. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882 and 1883: three very large specimens, two of which are upwards of a foot in length, by fully fourteen inches in height, as measured obliquely in the direction of the main axis of the valves.

In the largest individuals the concentric undulations become obsolete in the basal or anterior two-thirds of the shell, and the test, which is only about two millimetres thick near the ventral margin, is nearly smooth, and only faintly and concentrically striated on its outer surface. The outline of the largest and most perfect of the Swift Current specimens, which appear to belong to the variety *Nebrascensis*, is singularly like that of Sowerby's figure of *I. latus*, Mantell, in vol. VI., p. 159, tab. 182, fig. 1 of the Mineral Conchology.

INOCERAMUS TENUILINEATUS, Hall and Meek.

Plate 5, figs. 1 and 1 a.

Inoceramus tenuilineatus, Hall and Meek. 1854. Mem. Am. Ac. Arts and Sci., Boston, vol. VIII., p. 387, pl. 2, figs. 3a, b.
" " Meek. 1876., Rep. U.S. Geol. Surv. Terr., vol. IX., p. 57. pl. 12, fig. 6.
Inoceramus tenuilineatus, Whitfield. (as of H. and M.) Pal. Black Hills Dakota, p. 400, pl. 9, figs. 12; 13.

Blood Indian Creek, longitude 110° west,—also Elbow of the South Saskatchewan River, Prof. J. Macoun, 1879: two fine specimens, which belong to that form of the species in which the concentric undulations are unusually strong and well-defined, from each of these localities.

GERVILLIA RECTA, Meek and Hayden.

Gervillia recta, Meek and Hayden. 1861. Proc. Ac. Nat. Sc., Phil., vol. XIII, p. 441.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 66, pl. 29, figs. 1 a, b.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: one nearly perfect and very typical specimen, with fragments of others in the same hand specimen of rock.

GERVILLIA RECTA, var. BOREALIS. (Var. nov.)

Plate 4, figs. 2, 2 a and 2 b.

Shell large and thick, attaining to a length of fully six inches, inequivalve, the left valve being usually compressed convex and obliquely flattened posteriorly and immediateiy under the posterior wing, but rarely rather strongly convex, while the right valve is uniformly almost flat: lateral margins of the valves not distinctly tortuous.

Main body of the shell, exclusive of the posterior wing or alation, elongated and narrow, about three times as long as high, very obliquely sublanceolate or semi-lanceolate in outline, its upper boundary, under the posterior alation, being nearly straight, and its lower margin very broadly and convexly arched: posterior extremity generally subtruncated almost vertically. Including the posterior alation, the maximum height is nearly equal to one-half the entire length. Posterior wing large and long, occupying more than one-half the entire length, its posterior margin obliquely and concavely emarginate: anterior wing almost obsolete, small, angular and pointed in front. Hinge-line long and straight, between one-half and two-thirds the entire length in the largest specimens: beaks minute and inconspicuous, anterior but not quite terminal.

Surface marked with a few, irregularly disposed, concentric lines of growth. Cartilage pits apparently six, the three anterior ones separated by intervals of about equal breadth with themselves, the three posterior ones much more distantly disposed.

Muscular scars very faintly impressed and not perceptibly excavated. Posterior muscular scars very large, elongated in a direction nearly parallel with the longer axis of the valves, narrowly ovate, acutely pointed above and narrowly rounded below, their pointed extremities placed immediately under the posterior termination of the hinge and their outer margins close to and parallel with the upper margin of the posterior ends of the valves. Anterior muscular scars about half as large as the posterior, and narrowly elongated in nearly the same direction, pointed above and below, broadly convex on their outer and straight on their inner sides, placed high up in and partly across the angles formed by the hinge-line and the anterior margins.

Belly River, west of the mouth of the St. Mary River, G. M. Dawson, 1881: and Belly River, near the mouth of the St. Mary River, R. G. McConnell, 1881: St. Mary River, near the Police Fort, T. C. Weston, 1883: South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882 and 1884. Lorne Crossing of the Red Deer River, Township 35, Range 16, west of 4th Principal Meridian: and Berry Creek, Section 31, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884. One or two more or less perfect but usually very large specimens from each of these localities.

This variety, if indeed it be sufficiently well marked to be called a variety, appears to differ chiefly from the type of the species in its much larger size and in the proportionately greater length of its posterior wing. One of the specimens collected by Mr. Tyrrell on the Red Deer River, which is five and a half inches in length, apart from the greater proportionate length of its posterior alation, is so like Meek's figure of *G. recta* that it can scarcely be separated from that species even as a variety. It is not improbable that Meek's types of *G. recta* are immature shells and that the specimens from the Canadian North-West, which are very characteristic of the Fort Pierre Group of that region, may represent merely the adult form of the species.

MODIOLA ATTENUATA, Meek and Hayden.

Mytilus attenuatus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 86.

Modiola attenuata, Meek and Hayden. 1860. Ib., vol. XII., p. 427.

Volsella attenuata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 74, pl. 28, figs. 8a, b.

St. Mary River, near its confluence with the Belly River, T. C. Weston, 1883: abundant. Three miles north of Ross Coulée, near Irvine Station on the Canadian Pacific Railway, T. C. Weston, 1884.

MODIOLA (BRACHYDONTES) DICHOTOMA. (N. Sp.)

Plate 4, figs. 3 and 3a.

Shell equivalve, rather strongly convex when adult, thickest on the rounded umbonal ridge, which is moderately prominent and tolerably well defined as far as the middle of the valves, but which widens and gradually becomes obsolete towards and at the posterior end of the base: maximum thickness about equal to the height in fully grown specimens and about one-fourth less than the height in immature ones. Lateral outline somewhat variable in different specimens, the largest being subelliptical with a slightly arcuate base, while those which are not quite full-grown are narrowly subtrapezoidal; length about twice the maximum height. Anterior side narrow and extremely short, its margin retreating abruptly, obliquely, and more or less convexly downwards and inwards; posterior side considerably elongated and much broader than the anterior, broadest a little behind the middle, its superior border broadly arched in the largest specimens and faintly and obtusely subangular at the termination of the hinge line behind in smaller individuals, its basal margin shallowly arcuate or nearly straight, and its extremity narrowly rounded below the middle. Beaks small, anterior, terminal or very nearly terminal.

Surface marked by a few concentric lines of growth, and by numerous minute, rounded, radiating ribs, which curve upwards and outwards and are distinctly dichotomous on the posterior area, but which are apparently not so distinctly dichotomous below the umbonal ridge.

Dimensions of a perfect cast of the interior of the largest specimen collected: length, twenty millimetres; maximum height, ten mm.; thickness through the closed valves, seven mm. and a half. A smaller right valve with the test preserved is eleven mm. in length, and seven in its greatest height.

St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883; two casts of the interior and a perfect right valve, with most of the test preserved.

NUCULA CANCELLATA, Meek and Hayden.

Nucula cancellata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 85.

" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 102, pl. 28, figs. 13a, b, c, d, e.

St. Mary River, eleven miles above its mouth, G. M. Dawson, 1881:

one perfect and beautifully preserved specimen, with the test preserved on both valves and entirely freed from the matrix.

YOLDIA SCITULA, Meek and Hayden.

Pl. 5, fig. 2.

Nucula scitula, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 84.
Leda scitula, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Leda (*Yoldia*) *scitula*, M. and H. 1860. Ib., p. 428.
Yoldia scitula, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 110, pl. 28, fig. 9.

Twelve miles east of White Mud River, on trail to Woody Mountain, one well preserved right valve, and 49th Parallel, on the east branch of the Poplar River (the place called "Woody Mountain Astronomical Station" on page 107 of Dr. Dawson's Report on the Geology and Resources of the Country in the Vicinity of the 49th Parallel): a mould of the exterior of a left valve: both collected by G. M. Dawson in 1874, while on the staff of H.M. North American Boundary Commission.

The identification of these two specimens is not entirely satisfactory, their characters agreeing better with Meek's descriptions than with his figures of *Y. scitula*. Meek's latest statement in regard to that shell is that its posterior side is "subangular or very narrowly rounded in outline," but in the figure the posterior side is represented as subangular above. In both of the specimens collected by Dr. Dawson the posterior side is very narrowly rounded, both above and below, and there is no trace of any angularity above.

YOLDIA EVANSI, Meek and Hayden.

Nucula Evansi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 84.
Leda Evansi, Meek and Hayden. 1860. Ib., vol. XII, p. 185.
Leda (*Yoldia*) *Evansi*, Meek and Hayden. 1860. Ib., p. 429.
Yoldia Evansi, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 111, pl. 28, figs. 10, a, b, c.

South Saskatchewan, fifteen miles west of the mouth of Swift Current Creek, R. G. McConnell, 1882: a single right valve. Old Wives' Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: several imperfect and not very well preserved specimens.

LUCINA OCCIDENTALIS, Morton.

Tellina occidentalis, Morton. 1842. Jour. Ac. Nat. Sc., Phil., vol. VIII, p. 210, pl. 11, fig. 3.
Mould of *Lucina?* Owen. 1852. Rep. Geol. Surv. Wisc., Iowa and Minn., pl. 7, fig. 8.
Lucina occidentalis? Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 272. Not *Lucina occidentalis*, Reeve, 1850.
" " Meek (as of Morton). 1876. Rep. U.S. Geol. Surv. Terr., vol. IX, p. 134, pl. 17, figs. 4, a, b, c, d.

Bull Pound Creek, Section 3, Township 26, Range 14, west of 4th Principal Meridian, J. B. Tyrrell, 1884: ten specimens, with both valves and the test preserved. Old Wives' Creek, Township 10, Range 11, west of 4th Principal Meridian, R. G. McConnell, 1884: two small specimens which belong to the form to which Hall and Meek gave the name *L. subundata.*

The largest individuals from Bull Pound Creek are exactly like Meek's representations of *Lucina occidentalis* on plate 17, figures 4 a and 4 b, of the ninth volume of the United States Geological Survey of the Territories, but the smaller ones correspond quite as closely to his figures of *L. subundata* on the same plate. The few Lucinæ which have yet been collected from the Fort Pierre Group of the Canadian North-West, however, all clearly belong to a single species, and it is extremely probable that *L. subundata* is only the young of *L. occidentalis*, as Mr. Meek has suggested may be the case. In reference to these two nominal species and to the variety *ventricosa*, Mr. Meek remarks (on page 136 of the volume last cited), "it may be possible that all three of the types here described are merely varieties or represent different ages of the same species. Indeed, I confess that I am not altogether satisfied with the conclusion that they belong to more than one species; but having already separated them, it is perhaps better to continue this arrangement than to unite the whole under one name doubtfully."

TANCREDIA AMERICANA, Meek and Hayden.

Hettangia Americana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 274, and (1860) Ib., vol XII., p. 185.
Tancredia Americana, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 142 pl. 38, figs. 1, a, b, c, d, e, f, g, h.

Berry Creek, Section 31, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884: one adult specimen with the valves spread out on a piece of sandstone.

CYPRINA OVATA, Meek and Hayden.

Cyprina ovata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX., p. 144.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 146, pl. 129, figs. 7 a, b, c, and woodcut, fig. 8.

VARIETY ALTA. (Var. nov.) Plate 5, fig. 3.

Shorter than the typical form and broader in the direction of its height.

Belly River, near and a little west of the mouth of St. Mary River, also below Horse Shoe Bend, G. M. Dawson and R. G. McConnell, 1881; St. Mary River, near its confluence with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883: extremely abundant and well preserved at each of these localities, the prevalent form being apparently the var. *alta.*

St. Mary River, west of MacLeod Benton Trail, R. G. McConnell, 1881, mostly the *var. alta.* South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: the typical form apparently most prevalent. Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884: many casts of the interior of shells of the typical form and a few of the *var. alta.*

An exceedingly abundant and characteristic species in the Canadian North-west. The specimens are often very perfect and beautifully preserved, and the variety *alta* seems more common than the type, though the two forms are usually if not invariably found associated together at each of the localities from which the species has been collected.

CORBICULA OCCIDENTALIS, Meek and Hayden.

(For the synonymy, &c., of this species see page 7).

A few imperfect and badly preserved specimens of a *Corbicula* which are apparently referable to this species were collected by Dr. G. M. Dawson in 1883, at the base of the Fort Pierre Group, at Milk River Ridge, associated with an abundance of *Ostrea subtrigonalis*, and with a fragment of a *Unio.*

PROTOCARDIA SUBQUADRATA, Evans and Shumard.

Plate 5, figs. 4, and 4 a.

Cardium subquadratum, Evans and Shumard. 1857. Trans. Ac. Nat. Sc. St. Louis, vol. 1, p. 39.

Protocardia (*Leptocardia*) *subquadrata*, Meek (as of E. and S.). 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 175, pl. 29, figs. 8a, b, c, d, e.

South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: very abundant. Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: not uncommon. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway., T. C. Weston, 1884: a number of casts of the interior of the closed valves. Four miles south of Battle River, Township 38, between Ranges 12 and 13, west of 4th Meridian, J.B. Tyrrell, 1884.

Some badly preserved, imperfect and immature specimens of a small *Protocardia* collected by G. M. Dawson on the Smoky River, in 1879, which were referred by the writer to the *P. rara* of Evans and Shumard in a provisional list of the fossils of that locality on page 124 B. of the "Report of Progress" of the Canadian Survey for 1879-80, most probably also belong to the present species.

PROTOCARDIA BOREALIS. (N. Sp.)

Plate 6, figs. 1, 1 a, 2, 2 a, and 3.

Shell of medium size for the genus, specimens varying from a little less than an inch to an inch and five-eighths in length; valves rather strongly convex, thickest just above the mid-height; lateral outline varying in different specimens from rounded subquadrangular to obliquely and broadly subovate; length slightly exceeding the maximum height. Anterior side very short, its extremity regularly rounded; posterior side rather longer than the anterior, its extremity somewhat obliquely sub-truncated above, and rather narrowly rounded at the base below. Superior border descending very abruptly in front of the beaks, nearly straight and parallel to the ventral margin behind, cardinal margin short, ventral margin nearly straight in the middle and for the greater part of its length; umbones broad, oblique, and obtusely angular behind; beaks placed in advance of the middle (in some specimens very near to the anterior margin) curved inwards and downwards with a slightly forward inclination.

Surface nearly smooth but marked with very fine and closely arranged concentric striæ, also by a few distant lines of growth, which latter are waved and toothed on the posterior area, where they are crossed by obscure, rounded, radiating ribs. These ribs, though obsolete above, are sufficiently well marked below to cause an interlocking of the margins of the valves at the posterior end of the base.

Hinge dentition unknown; anterior and posterior muscular scars nearly equal in size, the anterior broadly subovate and higher than broad, the posterior somewhat pointed both above and below; pallial line not clearly indicated.

Dimensions of an average individual: length, twenty-three millimetres; maximum height, twenty-one mm. and a-half; thickness through the closed valves, seventeen mm. A large cast of the interior of a shell, from near Ross Coulée, which is probably referable to this species, measures forty-one millimetres in length by thirty-nine in height.

St. Mary River, near its junction with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883: very abundant. St. Mary River, W. of MacLeod Benton Trail, R. G. McConnell, 1881, and South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884, associated with *P. subquadrata.*

CALLISTA (DOSINIOPSIS) DEWEYI, Meek and Hayden.

Plate 6, figs. 4, 5, and 5 a.

Cytherea Deweyi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 83.
Meretrix Deweyi, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
Callista Deweyi, Meek and Hayden. 1861. Ib., vol. XIII., p. 143.
Callista (Dosiniopsis) Deweyi, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 182, pl. 17, figs. 15a, b, c, d, e.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: five specimens, some of which shew the hinge dentition well, and others the pallial sinus. Hill south of Big Plume Creek, Township 8, Range 5, west of 4th Principal Meridian, R. G. McConnell, 1883: nine unusually perfect examples of a shell which is probably only a large form of *C. Deweyi*, but which, in shape and size, approaches very closely to the *C. Owenana* of Meek and Hayden.

In the "Palæontology of the Black Hills of Dakota" (page 416) Prof. Whitfield places *C. Deweyi* among the synonyms of Morton's

Cytherea Missouriana, but with a query, and calls the latter shell *Dosinia Missouriana*. Under the circumstances it is thought best to retain Meek and Hayden's name for the Canadian specimens, first, because they are much more like Meek's figures of *C. Deweyi* than they are to either Morton's or Whitfield's figures of *Cytherea* or *Dosinia Missouriana*, and secondly, because they clearly do not belong to the genus *Dosinia*.

MACTRA (CYMBOPHORA) WARRENANA, Meek and Hayden.

Mactra Warrenana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 271.
Mactra (Cymbophora) Warrenana, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 208, pl. 30, figs. 7, a, b, c, d.

South Saskatchewan, five miles above Swift Current Creek, R. G. McConnell, 1883: two specimens. Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1883; a single left valve.

MACTRA (CYMBOPHORA) GRACILIS, Meek and Hayden.

Mactra gracilis, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.
Mactra (Cymbophora) gracilis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 209, pl. 17, figs. 18a, b.

East Branch of the Poplar River, on the 49th Parallel (the place called "Woody Mountain Astronomical Station" on page 107 of Dr. Dawson's "Report on the Geology and Resources of the country in the vicinity of the 49th Parallel"), G. M. Dawson, 1874, H.M. North American Boundary Commission: abundant and well preserved.

LIOPISTHA (CYMELLA) UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 81.
Liopistha (Cymella) undata, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

St. Mary River, near its junction with the Belly River, G. M. Dawson, 1881, and T. C. Weston, 1883. South Saskatchewan, opposite mouth of Swift Current Creek, R. G. McConnell, 1882: very abundant.

Bull's Head, about twenty-two miles west of the west end of the Cypress Hills, R. G. McConnell, 1883: abundant. Berry Creek, Township 25, Range 12, and four miles south of Battle River, Township 38, between Ranges 12 and 13, both west of 4th Meridian, J. B. Tyrrell, 1884. Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884: abundant.

A very common and widely distributed species in the Upper Cretaceous rocks of the Canadian North West.

NEÆRA MOREAUENSIS, Meek and Hayden.

Corbula Moreauensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 83.
Neæra Moreauensis, Meek and Hayden. 1860. Ib., vol. XII., p. 185.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX. p. 239, pl. 17, figs. 11a, b, c.
" " Whitfield (as of Meek). Pal. Black Hills, Dakota, p. 420, pl. 11, fig. 31.

Old Wives Creek, Township 10, Range 11, west of Third Principal Meridian, R. G. McConnell, 1884: two specimens.

PANOPÆA SUBOVALIS. (N. Sp.)

Plate 6, figs. 6 and 6 a.

Shell nearly equivalve, rather strongly convex, most prominent a little above the middle, and slightly in advance of the mid-length, obliquely compressed behind; lateral outline transversely and broadly suboval; length not quite one-third more than the maximum height; posterior termination of the valves gaping. Anterior side a little shorter than the posterior, its outer margin subangular at its junction with the superior border above, and retreating obliquely and rapidly both inwards and downwards in a broadly convex curve to the base below; posterior side abruptly contracted, its margin nearly straight above but rounding up very rapidly from the base below, its gaping termination narrow and subtruncated somewhat obliquely above the middle of the valves. Ventral margin broadly and convexly arched, rounding up rapidly at each extremity: superior border descending gradually in front of the beaks, and nearly straight behind; umbones moderately prominent; beaks placed a little in advance of the middle, apparently rather small and incurved, with a slightly forward inclination.

Surface markings of the test unknown, but the cast of the interior of the valves is marked by faint broad undulations. On a minute fragment of the test which happens to be preserved, there are indications of raised concentric striations.

Dimensions of the only specimen collected: Length, seventy-six millimetres (or about three inches); height, inclusive of the beaks, fifty-five mm.; maximum thickness through the closed valves, thirty-five mm.

Four miles south of Battle River, Township 38, between Ranges 12 and 13, west of 4th Meridian, J. B. Tyrrell, 1884: one cast of the interior of the united valves.

An apparently well marked species, characterized principally by its regularly inflated valves and its transversely broad suboval form, also by the abrupt contraction of its narrowly gaping posterior margin, and by the angularity of its anterior margin above.

Pieces of fossil wood which are completely riddled with the burrows of a species of *Teredo* or *Turnus* were collected by Mr. Tyrrell at the same locality and date as *Panopæa subovalis.* The posterior termination of each of these burrows is sphœrical in form, but as the shape and sculpture of the valves of the mollusk which made them are unknown, it is impossible to say to what species or even to what genus they should be referred.

GASTEROPODA.

HAMINEA OCCIDENTALIS, Meek and Hayden.

Bulla occidentalis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 69. (Not *B. occidentalis,* A. Adams, of earlier date.)

Bulla Nebrascensis, Meek and Hayden. 1861. Proc. Ac. Nat. Sc. Phil., vol XIII., p. 427.

Haminea occidentalis, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 271, pl. 18, figs. 11a, b, and 12a, b.

Blood Indian Creek, north of the Red Deer River and twenty miles east of the Hand Hills, Prof. Macoun, 1879: one well preserved cast of the interior of the shell. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882: a similar cast. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: four specimens, two of them with large portions of the test well preserved.

A cast of the interior of the shell of a very narrowly cylindrical species of *Cylichna*, which appears to be undescribed, but which does not afford sufficient characters for a satisfactory diagnosis, was collected by Mr. T. C. Weston, in 1884, three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway.

ACTÆON ATTENUATUS, Meek and Hayden.

Actæon (*Solidula?*) *attenuatus*, Meek and Hayden. 1858. Proc. Ac. Nat. Sc. Phil. vol. X., p. 54.
Solidula attenuata, Meek and Hayden. 1860. Ib., vol. XII., pp. 185 and 424.
Actæon attenuatus, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 281, pl. 19, figs. 17a, b.

Old Wives' Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: one good specimen with the test preserved.

CINULIA CONCINNA, Meek and Hayden.

Actæon concinnus, Hall and Meek. 1854. Mem. Ac. Arts and Sc., Boston, vol. V. (N. S.), p. 390, pl. 3, fig. 4.
Avellana subglobosa, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 64.
Avellana concinna, Meek. 1859. Hind's Rep. Saskatch. and Assinib. Expl. Exped. Toronto, p. 184.
Cinulia concinna, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII, p. 425.
Cinulia (*Oligoptycha*) *concinna*, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 284, pl. 31, figs. 6 bis., a, b, c.

Twelve miles east of White Mud River (or Frenchman's Creek), G. M. Dawson, 1873-74, H.M. North American Boundary Commission.

Elbow of South Saskatchewan, Prof. J. Macoun, 1879. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884. Not uncommon at each of these localities.

This species was first collected in Canada by Prof. H. Youle Hind in 1858, at "Two Creeks, on the Assiniboine."

ANISOMYON ALVEOLUS, Meek & Hayden.

Helcion alveolus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 68.

Anisomyon alveolus, Meek and Hayden. 1860. Am. Jour. Sc. & Arts, vol. XXVIII., (2nd series), p. 35.

Anisomyon alveolus, Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 292, pl. 18, figs. 4, a, b.

White Mud River (or Frenchman's Creek), near the 49th Paralle and south of Woody Mountain, G. M. Dawson, 1874, H. M. Nort American Boundary Commission: one imperfect specimen.

ANISOMYON CENTRALE, Meek.

Plate 7, figs. 1, 1 a, and 2, 2 a.

Anisomyon centrale, Meek. 1872. Rep. U. S. Geol. Surv. Terr. for 1870, p. 312.
" " White. 1876. U. S. Expl. & Surv. W. of 100th Merid., p. 194, pl. 18, fig. 8.
" " White. 1877. Hayden's U. S. Geol. & Geogr. Surv. Terr. Idaho and Wyoming, p. 303, pl. 9, figs. 1a, b, c & d.

Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: four large and well preserved casts of the interior of the shell.

No two of these specimens are alike either in shape or in surface markings, although they all agree to a certain extent in their conical form, elevated apex and in their being marked with from four to six radiating furrows. In two of these casts the apex is nearly central, but in the other two it is placed very near to the anterior end, and these latter approach rather nearly to the *A. borealis,* Morton (sp.), especially to the specimen figured under that name by Prof. Whitfield on plate 12, fig. 23 of the "Palæontology of the Black Hills of Dakota." Moreover, in each of the specimens collected by Mr. McConnell, the radiating furrows differ both in number and in their relative position. In one of the casts, too, there is a distinct and rather prominent ridge, which extends from the beaks backward to the posterior end of the base, and this is quite wanting in the other three.

In reference to Colorado specimens of *A. centrale,* Dr. C. A. White makes the following remarks, which are quite as applicable to those from Old Wives Creek. "This species seems to be at least as distinct from any of other published forms as they are from each other, but specific variation in this genus is evidently very great. Indeed, I think one cannot examine the original types of the published species and the collections subsequently made, together with the original descriptions and illustrations given by Mr. Meek in the publications of the United States Geological Survey of the Territories, without entertaining serious doubts whether more than two or three out of the seven published species of this genus from the Cretaceous strata of the United States are well founded."

LUNATIA CONCINNA, Hall & Meek. (Sp.)

Natica concinna, Hall & Meek. 1856. Mem. Am. Ac. Arts & Sc. Boston, vol. V., p. 384, pl. 3, figs. 2a, b, c, d.
Natica Moreauensis, Meek & Hayden. 1856. Trans. Ac. Nat. Sc. Phil., vol. VIII., p. 64 & ib., p. 282.
Natica (*Lunatia*) *Moreauensis*, Meek & Hayden. 1860. Ib., vol. XII., p. 422.
Lunatia concinna, Hall & Meek. (Sp.) Meek. Rep. U. S. Geol. Terr., vol. IX., p. 314, pl. 32, figs. 11a, b, c.

Elbow of the South Saskatchewan,—also Blood Indian Creek, north of the Red Deer River and twenty miles east of the Hand Hills, Prof. J. Macoun, 1879: one good specimen from the former locality, and two remarkably well preserved and large examples from the second.

The *Natica obliquata* of Hall and Meek, specimens of which were collected by Prof. H. Youle Hind at Two Creeks, on the Assiniboine, in 1858, is probably only a variety of this species.

ANCHURA AMERICANA, Evans and Shumard. (Sp.)

Rostellaria Americana, Evans and Shumard. 1857. Trans. St. Louis Ac. Sc., vol. I., p. 42. (Not R. *Americana*, d'Orbigny, 1826.)
Aporrhais Americana, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 423.
Anchura (*Drepanocheilus*) *Americana*, Meek. 1864. Smithson. Check-List N. Am. Cret. Foss., p. 19.
" " " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 325, plate 32, figs. 8, a, b.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858. Ross Creek, near Irvine Station, on the Canadian Pacific Railway, R. G. McConnell, 1883; three specimens. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian (two or three fragmentary examples), and North Woody Mountain, on a branch of Old Wives Creek, in Township 6, Range 4, west of the same Meridian, R. G. McConnell, 1884; five fine specimens.

The specimens collected by Prof. Hind, which are in the Museum of the Survey, are extremely small, but those since obtained by Mr. McConnell are much larger, and one of them is almost adult and shows part of the expanded outer lip.

VANIKOROPSIS TUOMEYANA, Meek and Hayden. (Sp.)

Natica Tuomeyana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc.. Phil., vol. VIII. p. 270.
Naticopsis Tuomeyana, Meek and Hayden. 1860. Ib., vol. XII., p. 423.
Vanikoropsis Tuomeyana, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 332, pl. 39, figs. 2 a, b.

Three miles north of Ross Coulée, near Irvine Station, on the Canadian Pacific Railway, T. C. Weston, 1884; four or five specimens. These are not more than half the size of the type of the species figured by Meek, and are probably not full grown shells, as they have not developed the "large, strong, oblique folds or plications".....“on th body volution," which are said to characterize the adult shell.

CEPHALOPODA.

BACULITES COMPRESSUS, Say.

Baculites compressus, Say. 1821. Am. Jour. Sc. & Arts, vol. II., p. 41.—Morton. 1834. Synops. Org. Rem. Cret. Gr. U. S., pl. 9, fig. 1; and Jour. Ac. Nat. Sc. Phil., vol. VIII., p. 211.—Hall and Meek. 1854. Mem. Amer. Ac. Arts & Sc., Boston, vol. V. (N. S.) p. 400, pl. 5, fig. 2 and pl. 6, figs. 8 and 9.—Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 421.—Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 400, pl. 20, figs. 3, a, b, c.

Creek twelve miles east of White Mud River (or Frenchman's Creek) and White Mud River near the 49th Parallel, also East Branch of the Poplar River, on the 49th Parallel (the place mentioned on p. 107 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the 49th Parallel" as that "where the Wood or Woody Mountain Astronomical Station was established"), G. M. Dawson, 1874, H. M. North American Boundary Commission. Elbow of South Saskatchewan, Prof. J. Macoun, 1879. Bow River, below Horse Shoe bend, and Belly River, five miles above Coal Banks, G. M. Dawson, 1881. St. Mary River, west of Mac Leod-Benton Trail, R. G. McConnell, 1881,—and Belly River, twenty-two miles and a half above the mouth of the Waterton, R. G. McConnell, 1882. Milk River Ridge,—and Red Deer River, above crossing of Lord Lorne Trail, R. G. McConnell, 1882. Ross Creek, near Irvine Station, on the Canadian Pacific Railway, R. G. McConnell, 1883. Bull Pound Creek, Sections 3 and 15, Township 26, Range 14, west of 4th Principal Meridian; Battle River, Township 38, between Ranges 12 and 13; and Berry Creek, Township 25, Range 12: J. B. Tyrrell, 1884.

The specimens from these localities appear to correspond well with the published descriptions and figures of *B. compressus*, and are characterized by their strong lateral compression, by their nearly smooth surface, and by the acute primary lobes in each septum. On page 107 of his British North American Boundary Commission Report, Dr. Dawson has quoted *Baculites ovatus* as occurring also at Wood Mountain Astronomical Station, but the specimens thus identified, which are in the Museum of the Survey, seem to the writer, on the whole, to accord better with the characters of *B. compressus*, though some of them appear to be almost intermediate between that species and *B. ovatus*.

BACULITES GRANDIS, Hall & Meek.

Baculites grandis, Hall and Meek. 1854. Mem. Am. Ac. Arts & Sc., Boston, vol. V. (N. S.), p. 402, pl. 7, figs. 1 and 2; pl. 8, figs. 1 and 2; and pl. 6, fig. 10.

" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., p. 398, pl. 33, figs. 1. a, b, c, and woodcut fig. 53.

East Fork of Milk River, in drift boulders, G. M. Dawson, 1874, H. M. North American Boundary Commission: two large specimens, the most perfect of which measures three inches and a quarter in its diameter, as measured from the siphonal to the antisiphonal side, at its largest extremity, by two inches and a half in its maximum lateral diameter.

According to Dr. Dawson,* "the valley of the East Fork of Milk River, where it crosses the Line, is wide and trough-like, with scarped banks about forty feet in height. The cliffs are composed entirely of drift deposits, and it maintains this character as far up and down as I have been able to examine it. Many fragments of Cretaceous fossils and large masses of fossiliferous ironstone, are found in the bed of the stream and in the clay banks; and so large a proportion of the drift is formed of the redistributed matter of the Cretaceous clay-shales, that it seems probable that they exist here at no very great depth. *Baculites grandis* is among the fossils, and was not elsewhere observed; there are also a few species which are probably derived from the lower beds of the Tertiary."

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* Rep. Geol. and Res. Reg. Vic. 49th Parallel, p. 114.

Specimens which appear to differ from those from the East Fork of Milk River only in being a little smaller, have since been collected at the following localities. St. Mary River, eleven miles above its mouth, G. M. Dawson, 1881; and Belly River, near the St. Mary River, R. G. McConnell, 1881. South Saskatchewan, opposite Swift Current Creek, R. G. McConnell, 1882; and Lorne Crossing of the Red Deer River, Section 24, Township 25, Range 16, west of 4th Principal Meridian, J. B. Tyrrell, 1884. None of the specimens from these localities, however, shew the septation and hence there may be a doubt whether they are correctly referred to *B. grandis* or not, but they seem to differ from the Baculites here referred to *B. compressus* in being thicker laterally, in having the antisiphonal side distinctly flattened, and in being marked by coarse and distant transverse undulations.

SCAPHITES ABYSSINUS, Morton. (Sp.)

Ammonites abyssinus, Morton. 1841. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 209 pl. 10, fig. 4.

Scaphites Mandanensis ?, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 281.

Scaphites abyssinus, Meek & Hayden. 1860. Ib., vol. XII., p. 420.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 441, pl. 35, figs. 2a, b & 4.

White Mud River, about twenty miles west of the crossing of Wood Mountain and Cypress Hills trails, R. G. McConnell, 1884: one perfect, adult and well preserved specimen, which is much more like Meek's figure 2a of *S. abyssinus* on plate 35 of his "Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri country, in volume IX. of the U. S. Geological Survey of the Territories," than it is to Morton's figure of the type of that species.

SCAPHITES NICOLLETI, Morton. (Sp.)

Ammonites Nicolletii, Morton. 1841. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 209, pl. 10, fig. 3.

" " Owen. 1852. Rep. U. S. Geol. Surv. Wiscon., Iowa and Minn., pl. 8, fig. 1.

Scaphites (*Ammonites*) *comprimis*, Owen. 1852. Ib., p. 580, pl. 7, fig. 4.

Scaphites Nicolletii, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 281.

Scaphites Nicolletii, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 435, pl. 34, figs. 4a, b, c & 2a, b.

Creek twelve miles east of White Mud River (or Frenchman's Creek),

G. M. Dawson, 1874, H. M. North American Boundary Commission: one well preserved but imperfect specimen. Old Wives Creek, Township 10, Range 11, west of 3rd Principal Meridian, R. G. McConnell, 1884: two nearly perfect specimens, which in this instance correspond better with Morton's figure of the type of his *A. Nicolletii*, than with Meek's subsequent illustrations of the same species.

SCAPHITES NODOSUS, Owen.

Scaphites (*Ammonites ?*) *nodosus*, Owen. 1852. Rep. Geol. Surv. Iowa, Wiscon. and Minn., p. 580, pl. 8, fig. 4.—Meek & Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 420.—Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX. pp. 426-430, pl. 25, figs. 1a, b, c; 2a, b, c; and fig. 4: also pl. 26, figs. 1a, b, c.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858: two imperfect and not very large specimens. Elbow of the South Saskatchewan, Prof. J. Macoun, 1879: one fine specimen which measures nearly five inches in its maximum diameter. South Saskatchewan, mouth of Swift Current Creek, R. G. McConnell, 1882: one specimen nearly as large as that collected by Prof. Macoun. West end of the Cypress Hills, R. G. McConnell, 1883: a medium sized example.

SCAPHITES SUBGLOBOSUS. (N. Sp.)

Plate 7, fig. 3, and plate 8, all the figures.

Shell strongly inflated, subglobose but narrowly and deeply umbilicated in the centre, attaining to a large size, the largest example collected, which is entirely septate, being nearly five inches in its maximum diameter, while the maximum breadth of its aperture, which is identical with the greatest lateral convexity, is three inches and a half. Volutions broadly rounded on the periphery and middle of the sides, but much more narrowly convex on their inner or umbilical sides, increasing rapidly in breadth laterally, but not so rapidly in diameter from the siphonal to the antisiphonal side,—closely involute and so deeply embracing that the whole of the inner ones are concealed, except in the largest individuals, in which a considerable portion of the last volution but one is exposed in the umbilical cavity: umbilicus about one-fourth of the entire diameter, with steep sides and an obliquely rounded and ill-defined margin. Aperture transversely reniform, nearly twice as broad as high and rather deeply emarginated by the encroachment of the preceding volution.

Surface marked by transverse and nearly straight ribs, which increase in number either by bifurcation or intercalation, especially in half grown and very young shells, so that there are often twice or perhaps three times as many on the centre of the periphery as on the umbilical margin. In specimens which measure about two inches in their greatest diameter and in still smaller ones, there is a row of distantly arranged small nodes on each side near the periphery of the outer volution and a faint tendency towards the same kind of sculpture around the umbilical margin. In the largest specimens, however, these rows of nodes are entirely obsolete. Septation, as far as it can be made out, apparently very like that of. *Scaphites nodosus.*

East Branch of the Poplar River, on the 49th Parallel, (the locality where the Wood Mountain Astronomical Station was established) G. M. Dawson, 1874, H. M. North American Boundary Commission : one large but rather imperfect specimen. Old Wives Creek, Township 10, Range 11, west of 3rd.Principal Meridian, R. G. McConnell, 1884: one large and nearly perfect specimen and several others varying from less than one inch to two inches in their greatest diameter.

The characters which are most relied upon for the separation of this species from *S. nodosus*, Owen, are the much greater size of the former and its more nearly globose form. The septation of both of these forms, indeed, appears to be much alike, and very young shells of *S. subglobosus* have a somewhat similar sculpture to *S. Conradi*, but in large individuals of the former the ribbed surface of the outer volution is entirely free from nodes.

PLACENTICERAS PLACENTA, Dekay. (Sp.)

Ammonites placenta, Dekay. 1828. Ann. N. Y. Lyc. Nat. Hist., vol. ii., p. 278, pl. 5, fig, 2 (3 by mistake).—Morton. 1829. Journ. Ac. Nat. Sc. Phil., vol. VI., p. 195 ; and Am. Journ. Sc. and Arts, vol. XVIII., pl. 2, figs. 1, 2 and 3 ; also, 1834, Synops. Org. Rem. Cret. Form. U. S., p. 36, pl. 2, figs. 1 and 2.

Placenticeras placenta, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 465, pl. 24, figs. 2a, b.

South Branch of the Saskatchewan, Prof. H. Youle Hind, 1858. White Mud River, (or Frenchman's Creek) on the 49th Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commission : one large and characteristic fragment. Blood Indian Creek, longitude 111° west, Prof J. Macoun, 1879 : one large specimen and two or three fragments. St. Mary River, near its mouth, G. M. Dawson, 1881 : one specimen which measures upwards of seventeen inches in diameter, and Belly River, west of St. Mary River, G. M. Dawson, 1881: two fragments; also, St. Mary River, west of MacLeod Benton trail, R. G. McConnell, 1881, three good examples, averaging about six inches in diameter. Lake south of Milk River, (a large fragment) and South Saskatchewan, opposite Swift Current Creek, (a large and perfect specimen fifteen inches in diameter) R. G. McConnell, 1882. Red Deer River, above crossing of Lord Lorne trail, R. G. McConnell, 1882, (one large fragment) and J. B. Tyrrell, 1884, a similar but smaller specimen.

PLACENTICERAS PLACENTA, var. INTERCALARE.

? *Ammonites syrtalis*, Morton. 1834. Synops. Org. Rem. Cret. Gr. U. S., p. 40, pl. 16 (14 by mistake), fig. 4.
Ammonites placenta, var. *intercalaris*, Meek & Hayden. 1860. Proc. Ac. Nat. Sc., Phil., vol. XII., p. 117.
? *Ammonites Tamulicus*, Blanford. M. S. S. 1862. Mem. Geol. Surv. India, vol. VI., p. 118.
? *Ammonites Guadaloupæ*, Stoliczka. 1865. Palæont. Indica, vol. I., p. 90, pl. 47, figs. 1 and 2, and pl. 48, fig. 1. Not *A. Guadaloupæ*, Rœmer.
Placenticeras placenta, var. *intercalare*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 468, pl. 23, figs. 1a, b, c.

St. Mary's River, near its mouth, G. M. Dawson, 1881: a nearly perfect and exquisitely preserved specimen, about five inches and a half in diameter, with the test preserved. In this specimen the double row of small nodes or tubercles which forms the outer boundary of the periphery and the single row which encircles the umbilicus on both sides of the shell are moderately well developed, but the row on the outer half of each of the sides is almost obsolete. Berry Creek, Township 25, Range 12, west of 4th Principal Meridian, J. B. Tyrrell, 1884: one imperfect specimen, in which all the rows of nodes and tubercles are fully developed.

D. FROM THE BELLY RIVER SERIES.

Dr. Dawson's views on the stratigraphical position of the "Belly River Series" are fully stated in pages 118-126 C, of the Report of Progress of the Canadian Survey for 1882-83-84. It is there explained that this name has been used to designate a considerable thickness of beds which occupy a position below the shales of the Fort Pierre Group, or at least below an upper portion of these shales. The beds of the "Belly River Series" are estuarine throughout, and differ in this respect from those described as occurring below the shales of the Fort Pierre Group in the Missouri region proper. Owing to the differences between the section in the Bow and Belly region and that on the Missouri, the exact stratigraphical position of the "Belly River Series" was for a long time considered doubtful, but Dr. Dawson has, on stratigraphical grounds, become convinced that it occupies the horizon assigned to it in his report. It may be added that Mr. R. G. McConnell, who assisted Dr. Dawson in the geological work, fully concurs in this opinion.

In the course of the explorations two sets of beds were at first distinguished, and these were provisionally recognized as the "pale" and "yellow" series respectively. These have now been united under the name "Belly River Series," the first named being the upper and the second the lower part of the series. It should be stated, however, that while (according to Dr. Dawson) the evidence is indubitable and precise as to the fact of the position of the pale or upper portion of these shales, that affecting the yellow or lower beds is somewhat less definite. The bearing of all the facts is discussed in the report above cited, and need not be repeated.*

The molluscan fauna of the pale or upper beds is comparatively scanty, though vertebrate remains, which have not yet been reported on, are somewhat abundant. It is unfortunate that the rather extensive collection of mollusca made from these beds by Mr. T. C. Weston at a locality in Milk River Ridge which proved unusually rich in fossils, and which was specially revisited in 1883 for the purpose of collecting them, was subsequently lost in transit. The yellow and supposed lower beds often contain great quantities of molluscan remains, and a number of species are represented.

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* In this connection it seems desirable to state that all the notes on the stratigraphical position and lithological peculiarities of the formations mentioned in the present paper were supplied by Dr. G. M. Dawson. Judging by their respective invertebrate faunæ, it would seem impracticable to separate the "Belly River Series" from the Laramie and more especially from the "Judith River Group," on purely palæontological evidence. (J. F. W.)

(1.) FROM THE PALE OR UPPER PORTION OF THE SERIES.

LAMELLIBRANCHIATA.

OSTREA GLABRA, Meek and Hayden.

(The synonymy of this species and references to the publications in which it was described will be found on page 5.)

Near Bull's Head, R. G. McConnell, 1883: a number of detached valves on a slab of limestone. Saskatchewan Coal Mines, near Medicine Hat, T. C. Weston, 1884: abundant.

OSTREA SUBTRIGONALIS, Evans and Shumard.

(For references to the publications in which this shell was described and figured, see also page 5.)

Woodworth Mine, Medicine Hat, R. G. McConnell, 1883: from the base of this portion of the series, common and associated with the preceding species.

PTERIA (OXYTOMA) NEBRASCANA, Evans and Shumard. (Sp.)

(For references to publications in which this species was described see page 31.)

Milk River Ridge, R. G. McConnell, 1882: a cast of a left valve, with a considerable portion of the test preserved.

MYTILUS SUBARCUATUS, Meek and Hayden.

Mytilus subarcuatus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil. vol. VIII., p. 276.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 69, pl. 38, figs. 2a, b.

South Saskatchewan, eight miles below the Red Deer River, R. G. McConnell, 1883: a few small but perfect specimens, the largest of which is not more than twelve millimetres or about half an inch in length.

CRENELLA (?) PARVULA. (N. Sp.)

Plate 9, fig. 1.

Shell small for the genus, (assuming it to be a *Crenella*) apparently not exceeding a quarter of an inch in length by one-third less in height, moderately inflated but very tumid in the umbonal region, lateral outline tranversely elliptic subovate, very narrow at the anterior end and increasing rapidly in breadth, or rather in height, to the posterior. Anterior side extremely small, its margin subtruncated almost vertically under the beaks: posterior side much longer and broader, its extremity regularly rounded. Beaks anterior, terminal and recurved.

Surface nearly smooth and marked only with very fine and close set concentric striæ, which are not visible without the use of a lens. Characters of the interior of the valves unknown.

Length of the largest specimen collected, six millimetres; maximum height of the same, four mm.; exact thickness through the closed valves not ascertainable with much accuracy.

Milk River Ridge, R. G. McConnell, 1882: three perfect single valves, with the test preserved on each.

It is possible that this little shell should be placed in Conrad's genus *Arcoperna** rather than in *Crenella*. If radiating striæ or costæ or a cancellate sculpture are essential characters of the latter genus, then it is clear that the present shell cannot be a *Crenella*. The only North American species to which the *C.* (?) *parvula* bears much resemblance is the *Modiola granulato-costellata* of Rœmer,† from the Texan Cretaceous, but this latter shell, as its specific name implies, has the outer surface of the valves marked with numerous, equal and granulated, radiating lines. Judging by the published figures, the *Crenella elegantula* of Meek and Hayden,‡ from the Fox Hills Group of Deer Creek and the Yellowstone River, is as broad or high anteriorly as it is posteriorly, and its surface is said to be marked with bifurcating radiating striæ.

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* Am. Journ. Conch., vol. I., p. 140, pl. 10, fig. 14.

† Die Kreidebildungen von Texas, p. 54, pl. 7, figs. 12 a, b, c.

‡ Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Invert. Cret. and Tert. Foss. U. Miss. Cy., p. 75, pl. 28, figs. 6, a, b, c

ANODONTA PROPATORIS ? White.

Plate 9, figs. 2 and 2 a.

Anodonta propatoris, White. 1877. Bull. U. S. Geol. Surv. Terr., vol. III., p. 601.
" " White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 61, pl. 24, figs. 2a, b, c and d.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 23, pl. 19, figs. 6, 7, 8 and 9.

Forty-ninth Parallel, six miles west of the first or South Branch of the Milk River, G. M. Dawson, 1874, H. M. North American Boundary Commission: one good specimen. Big Island bend, on the Belly River, G. M. Dawson, 1881: a few badly preserved casts of the interior of the shell. Milk River Ridge, R. G. McConnell, 1882: six casts of the interior of the united valves, with large portions of the thin test preserved. South Saskatchewan, eight miles above the mouth of the Red Deer River, R. G. McConnell, 1883: abundant. Red Deer River, Township 21, Range 12, west of 4th Principal Meridian, R. G. McConnell, 1883: two small casts. Near Bull's Head, R. G. McConnell, 1883: three casts of the interior of the adult shell.

The characters of the interior of the valves are not at all clearly shewn in any of the specimens from these localities. The hinge line appears to have been thin and edentulous, but it is impossible to ascertain definitely whether the pallial line had a sinus or not.

The form and surface markings of the exterior of the shell, which is nearly all that the Canadian specimens shew, are as much like those of the so-called *Thracia ? subtortuosa* of Meek* as those of *Anodonta propatoris*, and it is not at all unlikely that some if not all of the fossils now under consideration should be referred to the former species rather than to the latter.

All the specimens collected by Dr. Dawson and Mr. McConnell prior to 1883 were at first and for a long time supposed by the writer to be conspecific with *T. subtortuosa*. This opinion, too, seemed to be confirmed by the circumstance first that their tests showed scarcely any traces of an inner nacreous layer, and secondly by the fact that at Milk River Ridge they were obtained from a series of beds which hold *Mactra alta* (which occurs with *T. subtortuosa* at the mouth of the Judith River in Montana), and such other marine types as *Pteria*

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* Rep. U. S. Geol. Surv. Terr., vol. IX., p. 223, pl. 36, fig. 5.

Nebrascana, the *Crenella parvula* here described, and an undescribed gasteropod belonging apparently to the genus *Aporrhais* or *Anchura*.

On the other hand, at each of the localities at which these fossils were collected they are invariably and directly associated with numerous examples of one or more species of *Unio*, and at the South Saskatchewan and near Bull's Head with large *Physæ*. All the specimens of the present shell, too, which Mr. McConnell obtained at the South Saskatchewan in 1883, and which have most of the inner layer of the test preserved, are brilliantly nacreous, and young individuals, from more than one Canadian locality, are remarkably like Dr. White's figures of the young of *A. propatoris*.

UNIO PRIMÆVUS, White.

Unio primævus, White. 1877. Bull. U. S. Geol. Surv. Terr., vol. III., p. 599.
" " White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 70, pl. 29, figs. 3a and b.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 14, figs. 4 and 5.

Branch of East Fork of Milk River, Township 1, Range 27, west of 3rd Principal Meridian, R. G. McConnell, 1883: one specimen with both valves, but with most of the outer layer of the test exfoliated.

UNIO DANÆ, Meek and Hayden.

Unio Danæ, Meek and Hayden. 1857. Proc. Ac. Nat. Sc., Phil., vol. IX, p. 145.
" " Meek. 1876. Rep. U.S. Geol. Surv. Terr., vol. IX., Rep. Inv. Cret. and Tert. Foss. U. Miss. Cy., p. 517, pl. 41, figs. 3, a, b, c.

South Shore of the Belly River above Coal Banks, T. C. Weston, 1883 : four specimens, which are very variable in form.

UNIO CONSUETUS. (N. Sp. ?)

Plate 9, figs. 4 and 4 a.

Shell rather large, moderately convex, (the maximum thickness through the closed valves as compared with their height being about as three to five) transversely elongated, a little more than twice as long as high, very inequilateral, the anterior side being extremely short, and the posterior much produced; superior and inferior borders very nearly parallel for the greater part of their length. Margins of both extremities evenly rounded in some specimens, but in others the posterior end is bluntly pointed just below the middle. Superior border descending obliquely, convexly and abruptly in front of the beaks, nearly straight and horizontal, but slightly convex behind them: ventral margin also nearly straight except at the immediate extremities,—apparently never concavely arcuate near the centre; sides of the valves also never concave near the midlength below. Beaks very small, depressed, ill defined and approximated, placed very near the anterior margin but not quite terminal.

Surface marked with the usual concentric lines of growth. Hinge dentition unknown.

Dimensions of the most perfect specimens collected: length, one hundred and fifteen millimetres, or a little more than four inches and a half: height of the same, fifty-one mm. In this individual, which is a little distorted and twisted to one side, the valves are partially open, so that the exact thickness through them is difficult to ascertain, but in another specimen which appears to belong to the same species and whose valves are closed, the maximum height is fifty millimetres, and the greatest thickness of both united is about thirty.

The species attains to a still larger size than this, for a cast of the interior of the valves from another locality measures fully one hundred and thirty-five millimetres in length, by sixty-five in height.

Milk River Ridge, R. G. McConnell, 1882: one very large and nearly perfect cast of the interior of both valves. Red Deer River, Township 21, Range 12, west of 4th Principal Meridian, R. G. McConnell, 1883: one perfect specimen with the whole of the test preserved, three imperfect but well preserved specimens, and one cast of the interior.

Some casts of a large *Unio*, which are probably also referable to this species, were collected by G. M. Dawson in 1874, six miles west of the first branch of the Milk River, while attached to H. M. North American Boundary Commission; also, in 1881, on the Bow River, ten miles below Grassy Island,—and by Mr. McConnell, in 1883, on the South Saskatchewan, eight miles above the mouth of the Red Deer River.

So few perfect specimens of this shell have yet been obtained that its specific relations are by no means clear. The specific name suggested for it, which must be regarded as purely provisional, is intended to convey the idea that its characters are of a very *ordinary* kind and ones that are shared by it in common with many fossil and recent species of *Unio*. It may be only an unusually large variety of *Unio Danæ*, but appears to be proportionately broader in the direction of its height than that shell is, its ventral margin is not distinctly arcuate, if at all, and its flanks are never shallowly concave near the midlength below. The type and only specimen known of the *Unio Albertensis* of the "Willow Creek Series," described on page 3, looks very much like an immature shell, and it is not impossible that *U. consuetus* may ultimately prove to be the adult state of that species. There is also a considerable resemblance between the only perfect specimen known of *U. consuetus* and the *U. Couesi* of Dr. C. A. White, as figured on plate 27 of his "Contributions to Palæontology," (Nos. 2–8) published at Washington in 1880, under the auspices of the U. S. Geological Survey.

SPHÆRIUM FORMOSUM ? Meek and Hayden, VAR.

Plate 9, fig. 3.

Cyclas formosa, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII. p. 115.
Cyclas fragilis, Meek and Hayden. Ib.
Sphærium formosum, Meek and Hayden, 1860. Ib., vol. XII. p. 185.
" " " " " G. M. Dawson, 1875. Rep. Geol. and Res. Vic. 49th Parallel, p. 119.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 526., pl. 43, figs. 4, a, b, c.

Shell small, moderately convex, most prominent above the middle, in the umbonal region, a little longer than high; anterior side short and narrowly rounded; posterior side broader and slightly rounded or very faintly subtruncated vertically, or at nearly a right angle to the postetior end of the hinge line, at its extremity. Superior border straight and nearly parallel with the ventral margin behind the beaks,—descending abruptly, obliquely and somewhat concavely in front of them; ventral margin broadly and regularly rounded; umbones tumid, beaks obtuse, raised very little above the highest level of the hinge margin and placed slightly in advance of the middle.

Surface marked with numerous, minute, close-set and regularly disposed concentric, raised striæ, which can scarcely be seen without the aid of a lens; also by a few distant lines of growth. Hinge dentition and muscular impressions unknown.

Length of the most perfect specimens, six millimetres and a half; maximum height of the same, five mm., and a half.

Ed. Mahan's Coulée, G. M. Dawson, 1881: apparently abundant but very badly preserved. Belly River, eight miles above Coal Banks, T. C. Weston, 1883, a few single valves.

By an accidental oversight no mention was made of this little *Sphærium* in the enumeration of the fossils of the "Western Laramie" in section A, on page 9. It, however, was first discovered on the Second or North Branch of the Milk River, in 1874, by G. M. Dawson, as stated in his British North American Boundary Report, in rocks which he has since designated as the St. Mary River Series.

It is doubtful whether this *Sphærium* should be regarded as merely a local variety of the *S. formosum*, or as a distinct species. As compared with Meek's description of *S. formosum*, the specimens collected by Dr. Dawson and Mr. Weston are not nearly so much pointed at the posterior end of the base, nor so obliquely truncated posteriorly, and the cardinal margin, in the Canadian specimens, is more nearly parallel with the ventral.

MACTRA (CYMBOPHORA) ALTA, Meek and Hayden.

Mactra alta, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 271.
Mactra (*Cymbophora*) *alta*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 210, pl. 37, figs. 2, a, b.

Milk River Ridge, R. G. McConnell, 1882: five or six large single valves.

CORBULA SUBTRIGONALIS, Meek and Hayden.

Corbula subtrigonalis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII, p. 116.
Corbula (*Potamomya*) *subtrigonalis*, Meek and Hayden. 1860. Ib., vol. XII., p. 432.
Corbula subtrigonalis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 529, pl. 40, figs. 3, a, b. Illustrated also on pl. 19, figs. 10–17, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am.

Peigan Creek, Township 7, Range 6, west of 4th Principal Meridian, R. G. McConnell, 1883: a small piece of rock containing a few detached valves of this species.

CORBULA PERUNDATA, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 116.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530. pl. 40, figs. 4 a, b, c, d.

With the preceding, of which, as already remarked on page 9, Dr. C. A. White thinks it only a variety;—also near the U. S. Boundary line, on a branch of the east fork of the Milk River; at both places collected by R. G. McConnell in 1883.

GASTEROPODA.

PHYSA COPEI, White.

Physa Copei, White. 1877. Bul. U. S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2–8, p. 85, pl. 24, figs. 4 a and b.
" " 1883. Rev. Non-Marine Foss. Moll. N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

South Saskatchewan, eight miles above the mouth of the Red Deer River, R. G. McConnell, 1883: a few specimens with the test preserved. Near Bull's Head, same collector and date: two large casts of the interior.

Imperfect specimens of a few additional species of gasteropoda, which are either too badly preserved to be determined, or properly characterized if new, were obtained at various localities from this subdivision of the Belly River Series.

One of these is an elongated, spiral and evidently marine shell, from Milk River Ridge, which is most likely the young of a new species of *Aporrhais* or *Anchura*, but which may be a *Scalaria*. It has at least six rounded and ventricose shells with a deep suture, and its sculpture consists of strong and straight ribs, which cross the volutions transversely but somewhat obliquely, and there are no indications of any spiral or revolving markings.

A second elongated, spiral shell, which occurs in the Belly River above Coal Banks and at Milk River Ridge, may be an extreme variety of *Goniobasis tenuicarinata*, or perhaps a new species of *Spironema*. It also has about six very ventricose whorls and a deeply excavated suture, but its volutions are sub-angular above, and the sculpture of its later whorls consists of four small spiral raised ridges.

Fragments of a large *Viviparus* which is probably *V. Conradi* were collected by Mr. McConnell in 1883 on the South Saskatchewan, eight miles above the Red Deer River and on the Red Deer River, while numerous perfect opercula, which resemble those of *Viviparus* and *Campeloma* except in being smaller, thicker and apparently calcareous, were obtained by Mr. T. C. Weston in the same year from the Belly River, eight miles below Coal Banks.

(2.) From the Lower or Yellowish and Banded Portion of the Series.

LAMELLIBRANCHIATA.

Anomia micronema, Meek.

Anomia micronema, Meek. 1875. Bull. U.S. Geol. Surv. Terr., 2nd Ser., No. 1, p. 43.
" " Meek. White. 1880. U. S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 57, pl. 25, figs. 2, a, b, c, d. Illustrated also on pl. 12 (figs. 6-11), of Dr. White's Rev. Non-Marine Foss. N. Am. Washington, 1883.

South Saskatchewan, half a mile below the forks of the Bow and Belly Rivers, T. C. Weston, 1883: one perfect well-preserved specimen of the upper valve.

Ostrea glaba, Meek and Hayden.

(The full synonymy of this species and references to the publications in which it was described are given on page 5.)

South Saskatchewan, one mile below the mouth of the Bow River, G. M. Dawson, 1881, and T. C. Weston, 1883; also South Saskatchewan, six miles below the mouth of Bow River, and thirty-five feet above the water level, G. M. Dawson, 1881. North Bank of the Milk River, five miles below Pă-kow-kĭ Coulée, and south bank of Milk River, above Pă-kow-kĭ Coulée, forty and a hundred feet above the water level, G. M. Dawson, 1881.

Abundant and associated with *Corbula subtrigonalis and C. perundata* at each of these localities. Some of the specimens are very typical, others belong to the variety *arcuatilis*, Meek, and one from the South Saskatchewan comes very near to the *O. inornata* of Meek and Hayden from the Fort Pierre Group.

Anodonta parallela ? White.

Anodonta parallela, White. 1878. Bul. U.S. Geol. Surv. Terr., vol. IV., p. 709.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 62, pl. 24, fig. 3 a.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 23, pl. 19, fig. 5.

South Saskatchewan, one mile below the mouth of Bow River, T. C. Weston, 1883: one imperfect and badly preserved specimen, whose identification with the above named species is consequently somewhat doubtful.

UNIO PRISCUS, Meek and Hayden.

Plate 10, fig. 3.

Unio priscus, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 117.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr. vol. IX., p. 516, pl. 43, figs. 8 a, b, c, d.

Belly River, two miles above Woodpecker Island, G. M. Dawson, 1881: an imperfect but beautifully preserved right valve, which is almost certainly specifically identical with the similarly imperfect specimens from the Laramie of the Souris River District, already referred to this species on pages 26 and 27.

The "small, very regular, concentric wrinkles" on the beaks and "the two small, raised radiating lines which extend from the back part of the beaks obliquely backward and downward across the postero-dorsal region of the immediate umbones," which, according to Meek, are among the distinguishing characters of *U. priscus*, are extremely well shown in most of the specimens from the Canadian Laramie and Belly River Series. Both of these characters, however, are said to be common to *U. priscus* and to the *U. vetustus* of Meek from the Bear River Laramie, but on page 165 of the U. S. Geol. Surv. of the 40th Parallel under Prof. Clarence King (Washington, 1877), Mr. Meek states that he has "long suspected" that the latter shell "may possibly be identical" with the former.

A perfect but very immature specimen of a *Unio* collected by Mr. Weston in 1883 from the South Saskatchewan, one mile below the mouth of the Bow River, which measures only eighteen millimetres in its greatest length, and which is figured on plate 10, is possibly also referable to *U. priscus*, though it agrees quite as well with the description of *U. vetustus* and even better with the figures.

UNIO DANÆ, Meek & Hayden.

Unio Danæ, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 145.
" Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 517, pl. 41, figs. 13, a, b, c.

Belly River, north-west angle of Driftwood Bend, G. M. Dawson, 1881: abundant, typical and well preserved.

UNIO DEWEYANUS, Meek & Hayden.

Unio Deweyanus, Meek & Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 145.
" Meek. 1867. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 519, pl. 41, figs. 2, a, b, c. Illustrated also on pl. 17 (figs. 4 and 5) of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am. Washington, 1883.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883 : a few rather imperfect specimens.

As already stated on page 6, Dr. C. A. White is of the opinion that *U. Deweyanus* is only a variety of *U. Danæ*.

UNIO SUPRAGIBBOSUS. (N. Sp.)

Plate 10, fig. 1.

Shell compressed at the sides, the maximum convexity being apparently less than half the greatest height, though all the specimens so far collected are more or less crushed laterally,—rather tumid a little behind the mid-length and below the middle in some individuals, so that the outline of a section through the centre of the closed valves at a right angle to their length would be very nearly lenticular : a little longer than high, and very inequilateral : lateral outline obliquely and broadly subovate : superior border gibbous behind the beaks : posterior end of the base always somewhat pointed. Anterior side very short, its margin abruptly and more or less broadly rounded or receding obliquely and abruptly inwards and downwards from a little above the middle, into the base below : posterior side much longer than the anterior, its extremity obliquely truncated above and in the middle and narrowly rounded or bluntly pointed at the base below. Superior border broadly and convexly arched behind the beaks and probably winged when quite perfect : ventral margin broadly semiovate, usually much straighter behind than in front : umbonal region not distinctly defined as such and flattened laterally ; beaks small, inconspicuous, depressed considerably below the highest level of the superior border, and placed very near the anterior end but not quite terminal.

Surface concentrically striated. Hinge dentition and muscular impressions unknown.

Dimensions of the most perfect specimen collected : maximum length, sixty millimetres : greatest height of the same, about forty-six mm. : approximate thickness through the closed valves, about twenty mm.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: six nearly perfect but somewhat distorted specimens.

The lateral outline of this shell is a little like the young examples of *Unio gonionotus* figured by Dr. C. A. White on plate 26, figs. 2 c, d, e, of his "Contributions to Palæontology," Nos. 2-8 (U.S. Geol. Surv., Washington), but the posterior and postero-basal margins of the latter species are represented as coarsely plicated and its superior border as forming a subangular junction with the posterior margin behind. The present species also seems to be nearly related to the *U. Haydeni* of Meek from the Bridger Group of Wyoming,

UNIO SENECTUS, White.

Plate 10, fig. 2.

Unio senectus, White. 1877. Bull. U.S. Geol. Surv. Terr., vol. III., p. 600.
" " " 1880. U.S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 69, pl. 28, figs. 1 a, b and c.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 26, pl. 19, figs. 1, 2.

South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: one specimen which measures seventy millimetres in its greatest length by forty mm. in its greatest height, and five small specimens the largest of which is thirty-six millimetres long and twenty high.

The largest individual collected at this locality seems to differ a little from the type of *U. senectus* first figured by Dr. White in being subtruncated somewhat obliquely at the posterior margin rather than regularly rounded, and some of the smaller examples (such as the one represented on plate 10) have both umbonal slopes on each valve rather distinctly defined. These slight and apparently inconstant variations from the normal form, however, are obviously not of specific importance.

CORBICULA OCCIDENTALIS, Meek and Hayden.

(References to the publications in which this species was described are given on page 7.)

North side of the Milk River, five miles below Pā-kow-kī Coulée, G. M. Dawson, 1881: a number of well-preserved and nearly perfect single valves which are all quite empty and show the hinge dentition, muscular impressions and the small shallow subangular pallial sinus very clearly.

The specimens from this locality are slightly different in shape from those from the "Western Laramie" mentioned on page 7, but the *Corbiculæ* from the Milk River are also almost exactly intermediate in their characters between *C. occidentalis* and *C. cytheriformis*.

SPHÆRIUM FORMOSUM? Meek and Hayden, Var.

(A description of this shell, with references to the publications in which *S. formosum* was described, will be found on page 61.)

Belly River, east side of Driftwood Bend, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. A few single valves from each of these localities.

CORBULA SUBTRIGONALIS, Meek and Hayden.

Corbula subtrigonalis,	Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII. p. 116.
Corbula (*Potamomya*) *subtrigonalis*,	Meek and Hayden. 1860. Ib., vol. XII., p. 432.
Corbula subtrigonalis,	Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 529, pl. 40, figs. 3, a, b.
" "	White (as of Meek). 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8. p. 80, pl. 25, figs. 6, a, b, c, d, e.
" "	White. 1883. Rev. Non-Marine Foss. N. Am., p. 36, pl. 19, figs. 11–15.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881. North side of Milk River, five miles below Pă-kow-kī Coulée, and south side of Milk River, one mile above the mouth of Pă-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881.

South side of the Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Abundant at each of these localities.

CORBULA PERUNDATA, Meek and Hayden.

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc., Phil., vol. VIII., p. 116.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4, a, b, c, d.

Creek "about fourteen miles north-eastward from the most eastern of the Three Buttes," G. M. Dawson, 1874; very abundant: see page 122 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the Forty-ninth Parallel. Abundant also at all the localities at which *C. subtrigonalis* has yet been collected at this horizon in the "Belly River Series." As already stated on page 9, Dr. C. A. White thinks that *C. perundata* is not specifically distinct from *C. subtrigonalis*.

GASTEROPODA.

RHYTOPHORUS (?) GLABER. (N. Sp.)

Plate 10, figs. 4 and 4*a*, *b*, *c*.

Shell (when adult or nearly adult) ovately subfusiform, its length being about twice its maximum breadth: spire conical, moderately elevated: axis and base imperforate. Volutions about six, increasing rapidly in size, those of the spire obliquely compressed at the sides, the one next to the body whorl being moderately convex and the earlier ones much less so: suture lightly impressed. Body whorl large and long, though its length is rarely or never quite twice as great as its maximum breadth, obliquely compressed next to the suture, most prominent and somewhat shouldered a little above the middle, below which it narrows gradually into the more or less pointed or very narrowly rounded base. Aperture elongated and narrow, pointed both above and below, but most acutely so above: columella bearing at least one fold, which is prominent, oblique and situated at a short distance from the base: outer lip thin and apparently simple.

Surface polished, nearly smooth, marked only by minute and parallel lines of growth, which are faintly, minutely and shallowly curved backwards immediately next to the suture. Test rather thin.

Length of an average sized adult specimen, twenty-nine millimetres: maximum breadth of the same, fifteen mm.: length of the body whorl, twenty.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South side of the Milk River, one mile above Pă-kow-kĭ Coulée and forty feet above the water level, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Apparently common at each of these localities.

At Driftwood Bend a number of specimens were collected which appear to be very young or half grown shells of this species. These differ from adult or nearly adult examples in being narrowly fusiform, with an attenuated and extremely slender spire not unlike that of an *Acella*. One of these, which is figured on plate 10, fig. 4*c*, and which measures about ten millimetres in length, has as many as seven volutions, the first three of which are exceedingly slender, fragile and apparently non-persistent. The body whorl also of these half grown shells is often concavely but shallowly constricted next to the suture.

This shell is very doubtfully and only provisionally referred to Meek's genus *Rhytophorus*. It differs materially from the two described and typical species (the *R. priscus* of Meek and the *R. Meeki* of White) in the total absence of the "small, oblique, short folds around the top of the somewhat shouldered whorls" which suggested the generic name and which may or may not be an essential character. According to Meek* "a slight curve in these little folds or costæ indicates the presence of a faint sinus in the lip near the suture, somewhat as in *Schizostoma*, Lea, but much less deeply defined," and the type species is said to have "one rather strong oblique fold" on the columella below, "and a much smaller less oblique one about half way up the aperture." In the present species there is a similar slight curve in the lines of growth next to the suture, and a correspondingly oblique fold in the columella below, but the aperture of all the specimens is so much filled up with the matrix that it is at present impossible to ascertain whether there was a second fold or not, without great risk of injury to the specimens. It may be that the present shell is more nearly related to the South American fresh water genus *Chilina* than it is to *Rhytophorus*.

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* U. S. Geol. Expl. 40th Parallel under Prof. Clarence King, vol. IV., p. 175.

PLANORBIS PAUCIVOLVIS.[*] (N. Sp.)

Plate 10, fig. 5.

Shell very small, discoidal, thin, nearly flat or slightly concave on one side and apparently somewhat more convex near the circumference and depressed in the centre on the other. Volutions four, slender and increasing very slowly in size, their dorso-ventral diameter being not much greater than their breadth from side to side,—closely coiled but not very deeply embracing, so that the greater part of all the inner whorls is exposed to view, at any rate on the left or flattened side. Body whorl angulated at the junction of its left or flattened side with the periphery.

Surface markings unknown, the outer layer of the test being exfoliated in the only perfect specimen collected.

Maximum diameter of the largest specimen, about two millimetres and a half: greatest breadth of the same, approximately, three-quarters of a millimetre.

Belly River, near its junction with the Bow River, G. M. Dawson, 1881: two small and very badly preserved specimens. South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: one apparently adult and nearly perfect specimen and a smaller one.

The only perfect and tolerably well preserved example of this shell that has yet been obtained has most of the right side buried in the matrix.

PHYSA COPEI, White.

Physa Copei, White. 1877. Bul. U. S. Geol. Surv. Terr., vol. III., p. 602.
" " 1880. U.S. Geol. Surv. Terr., Contr. to Pal., Nos. 2-8, p. 85, pl. 24, figs. 4a and b.
" " 1883. Rev. Non-Marine Foss. Moll. N. Am., pp. 43, 44, pl. 25, figs. 1 and 2.

Belly River, near its junction with the Bow River, G. M. Dawson, 1881: one very small specimen. South Saskatchewan, six miles below the mouth of the Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: an embryonic example not quite three millimetres in length. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: a full grown individual, more than an inch and a half long.

THAUMASTUS LIMNÆIFORMIS, Meek and Hayden

Bulimus limnæiformis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 118.

Bulimus Nebrascensis, Meek and Hayden. Ib.

Thaumastus limnæiformis, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 553, pl. 44, figs. 8, a, b, c, d.

South Saskatchewan, six miles above the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: one nearly perfect specimen with the test preserved, and twelve casts of the interior of the shell.

The specimens from the Western and Souris River Laramie which have been referred to *T. limnæiformis* on pages 20 and 27 have sometimes as many as seven volutions rather than "from five to six," though in other respects they agree very well with Meek's description of that species, especially in their polished surface which is said to be marked only "by very fine, nearly obsolete lines of growth," in their moderately elevated spire which is represented as "a little obtuse at the immediate apex," and in the fact that their apertures and spires are nearly equal in length.

Premising that *Thaumastus* (Albers) is only a subgenus of *Bulimulus* (Leach) it is also to be noticed that the spires of such specimens as those figured on plate 3, whose nuclear whorls are exquisitely preserved, are much more like those of many recent species of *Bulimulus* from the West Indies and South America, when examined under a lens, than they are like those of any of the living species of *Goniobasis*.

Dr. C. A. White, to whom the originals of figures 3, 3a and 3b on plate 3 were submitted, was at one time inclined to think that they should possibly be regarded as a variety of the *Goniobasis invenusta* of Meek and Hayden, but if that view be correct, then *G. invenusta*, as suspected by Meek, can scarcely be a true *Goniobasis* and probably not even a fresh water shell. It may be that *T. limnæiformis*, *G. invenusta* and *Limnæa compactilis*, Meek, are more closely allied, both generically and specifically, than their names would lead the student to suppose.

The specimens collected by Dr. Dawson from the Belly River Series on the South Saskatchewan evidently belong to the same species as those from the Western and Souris River Laramie, though those from the first mentioned locality are a little larger and their spires are rather more produced in proportion to the entire length of the shell.

VELATELLA BAPTISTA, White.

Velatella baptista, White. 1878. Bull. U. S. Geol. Surv. Terr., vol. IV., p. 715.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 89, pl. 29, figs. 6 a, and b.
" " White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 52, pl. 23, figs. 16–20.

Coulée "about fourteen miles north-eastward from the most eastern of the Three Buttes," near the Forty-ninth Parallel, G. M. Dawson, 1874, H.M. North American Boundary Commission. The place mentioned on page 122 of Dr. Dawson's "Report on the Geology and Resources of the region in the vicinity of the Forty-ninth Parallel," &c.

Belly River, east side of Driftwood Bend, and Belly River near its junction with the Bow River, G. M. Dawson, 1881. South Saskatchewan six miles below the mouth of the Bow River, G. M. Dawson, 1881. South side of Milk River, one mile above the mouth of Pă-kow-kĭ Coulée, G. M. Dawson, 1881. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883. Apparently common at each of these localities.

Some of the specimens correspond almost exactly with Dr. White's descriptions and figures of the type of *V. baptista,* though the callus on the columellar side and the outer lip seem to be thickened to an unusual degree, while other individuals can scarcely be distinguished from the very nearly related *Velatella patelliformis* of Meek.

MELANIA ? INSCULPTA, Meek.

Plate 10, fig. 6.

Melania ? insculpta, Meek. 1873. Rep. U. S. Geol. Surv., p. 515.
Goniobasis insculpta, G. M. Dawson, as of Meek. 1875. Rep. Geol. and Res. reg. vic. Forty-ninth Parallel, p. 122.
Melania ? insculpta, Meek, White. 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 94, pl. 20, fig. 4 a.
Melania insculpta, White. (as of Meek) 1883. Rev. Non-Marine Foss. Moll. N Am., p. 54, pl. 26, figs. 4 and 5.

Coulée "about fourteen miles north-eastward from the most eastern of the Three Buttes" and near the Forty-ninth Parallel, G. M. Dawson, 1874, H. M. North American Boundary Commisson : four specimens.

South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level, G. M. Dawson, 1881; two fine examples, one of which is nearly perfect, and fully an inch and a half in length. North side of Milk River, five miles below Pā-kow-kī Coulée, —and south side of Milk River, one mile above the mouth of Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881: several specimens from each of these localities.

Dr. C. A. White's figures of this species, which are the only ones yet published, are taken from imperfect specimens, and do not give quite as clear an idea of its characters as Mr. Meek's original description does. The specimen from the South Saskatchewan represented on plate 10, is nearly perfect and has nine volutions preserved.

GONIOBASIS SUBTORTUOSA, Meek and Hayden.

Plate 10, fig. 7.

Melania subtortuosa, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 136.
Goniobasis ? subtortuosa, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 569, figs. 75 and 76 in text and pl. 42 figs. 17, a, b.
" " White (as of Meek). 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 94.
" " White (as of Meek). 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 57, pl. 27, fig. 34.

Shell elongate conical, the length being about twice as great as the maximum breadth, the apical portion rather slender: volutions six or seven, increasing somewhat gradually in size, those of the spire prominent, angulated and bearing a small but distinct spiral keel a little below the middle of their exposed surfaces, this keel being bordered beneath by a narrow groove which is well defined on the last whorl of the spire but which becomes less distinct on the body-whorl: suture deep in consequence of the prominence and angularity of the volutions. Body-whorl very little less than one half the entire length, and a little broader than long, angulated and distinctly keeled just above the middle, obliquely flattened between the suture and the keel and strongly convex at the base: axis imperforate or very nearly so. Aperture rhombic subovate, pointed above and narrowly rounded below.

Surface marked with close-set, regularly disposed and somewhat flexuous striations which cross the whorls transversely, but with no revolving markings other than the spiral keel, except one or two very faint and distant lines on the body-whorl near the keel.

Length of the most perfect specimen collected, eighteen millimetres:

maximum breadth of the same, as measured across the centre of the body-whorl, ten mm.: length or height of body-whorl, not quite nine mm.

Belly River, two miles above Woodpecker Island,—and Belly River, east side of Driftwood Bend, G. M. Dawson, 1881. South Saskatchewan, one mile above the mouth of the Bow River, T. C. Weston, 1883. Apparently not unfrequent at each of these localities.

The description given above and the figure on plate 10 are both taken from an unusually perfect and well preserved specimen collected by Mr. Weston on the South Saskatchewan. In Mr. Meek's diagnosis of the characters of *G. subtortuosa* the number of volutions is said to be "about five" and his measurements and figures of that shell do not correspond at all well with the proportions and contour of the Canadian specimens. Dr. C. A. White, however, who has kindly compared the fossil obtained by Mr. Weston with the specimen described and figured by Meek, informs the writer that the former is " without doubt the *G.* (?) *subtortuosa* of Meek and Hayden," and adds that Meek's type of that species is "imperfect and partially crushed," and that it would not warrant a definite determination of the number of whorls.

The only species with which the present shell is at all likely to be confounded is the *Cassiopella turricula* of White, but the latter is stated to have nine or ten volutions, its base is said to be distinctly umbilicated, and the spiral keel which encircles its spire is represented as placed considerably below the middle of each whorl.

It is difficult to see how *G. subtortuosa* can be separated generically from such living species as the *G. acutocarinata* of Lea and other forms belonging to that section of the genus.

HYDROBIA SUBCYLINDRACEA. (N. Sp.)

Plate 10, fig. 8.

Shell very small, narrowly elliptic-subovate, rather slender, the length being about one-third greater than the maximum breadth: volutions five, those of the spire very gently convex, their sides being compressed somewhat obliquely; last whorl of the spire nearly or quite equal to the body whorl in breadth or convexity: suture distinct: spire about twice as long as the aperture and rather obtuse at its immediate apex. Body-whorl comparatively narrow, subcylindrical above and imperforate at the base: aperture obliquely subovate, somewhat pointed above: outer lip simple and rather thin.

Surface smooth and polished.

Greatest length, three millimetres and a half: maximum breadth or convexity, a little over one mm.: length (or height) of body-whorl, about one mm.

Belly River, east side of Driftwood Bend, G. M. Dawson, 1881: one nearly perfect specimen with the test preserved. North side of Milk River, five miles below Pā-kow-kī Coulée, G. M. Dawson, 1881: a cast of the interior of the shell.

This little species appears to be much slenderer than any of the North American fossils which have been referred to the genus *Hydrobia* with the exception of the *H. recta* of White,* and the latter shell has a totally different outline to the present one, is said to attain to a length of eighteen millimetres and to have apparently twelve or more volutions.

VIVIPARUS CONRADI, Meek and Hayden.

Paludina Conradi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 122.
" " Meek and Hayden. 1860. Ib., vol. XII, p. 185.
" " Meek, 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 579, pl. 42, figs. 15, a, b, c, d.
" " White. (as of M. and H.) 1880. U. S. Geol. Surv. Contr. to Pal., Nos. 2-8, p. 100.
" " White (as of M. and H.). 1883. Rev. Non-Marine Foss. N. Am., p. 61, pl. 24, figs. 4, 5 and 6.

South Saskatchewan, six miles below the mouth of the Bow River and thirty-five feet above the water level, G. M. Dawson, 1881: large and abundant. South side of Milk River, one mile above the mouth of Pā-kow-kī Coulée and forty feet above the water level, G. M. Dawson, 1881: one specimen. South Saskatchewan, one mile below the mouth of the Bow River, T. C. Weston, 1883: not unfrequent.

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* Described on p. 132 of Powell's Rep. on the Geology of the Uinta Mountains, and figured on plate 27, fig. 38, of Dr. C. A. White's Review of the Non-Marine Fossil Mollusca of N. America.

CAMPELOMA MULTILINEATA, Meek & Hayden.

Paludina multilineata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 120.
Vivipara multilineata, Meek and Hayden. 1860. Ib., vol. XII, p. 85.
Vivipara Nebrascencis, Meek and Hayden. 1860. Ib., p. 430.
Melantho multilineatus, Meek. 1863. In Prof. Gill's paper on the *Viviparidæ*, Proc. Ac. Nat. Sc. Phil., vol. XV, p. 7.
Campeloma multilineata, Meek. 1866. In Conrad's Smithsonian Eocene List.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 586, pl. 44, figs. 1, a, b.
" " White. (as of M. & H.) 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2–8, p. 101, pl. 28, figs. 4a, b.
" " White. (as of M. & H.) Rev. Non-Marine, Foss. Moll. N. Am., p. 63, pl. 27, figs. 1–7.

Belly River, east side of Driftwood Bend,—and South Saskatchewan, six miles below the mouth of Bow River and thirty-five feet above the water level; G. M. Dawson, 1881: a few more or less perfect specimens from each of these localities. North side of Milk River, five miles below Pă-kow-kī Coulée, G. M. Dawson, 1881: two well preserved examples.

Some of the specimens from the Belly River show the "slight angularity at the distal side of the larger volutions" indicated in Dr. White's latest figures of the species and his explanations thereof, but those from the South Saskatchewan are more like the type originally figured by Meek and some are very near in their character to *C. vetula*, which, however, Meek thought might be a mere variety of *C. multilineata.*

CAMPELOMA PRODUCTA, White.

Campeloma (*Lioplax*?) *producta*, White. 1883. Rev. Non-Marine Foss. Moll. N. Am., p. 63, pl. 26, figs. 21–27.

South Saskatchewan, one mile below the mouth of Bow River, T. C. Weston, 1883: abundant.

From the collections made so far it would appear that *Ostrea glabra* and *O. subtrigonalis*, *Unio Danæ*, *U. senectus* and *U. priscus*, *Corbicula occidentalis*, *Sphærium formosum ?* var., *Physa Copei*, *Thaumastus limnæiformis*, *Campeloma producta* (and possibly *Corbula perundata*) are common to the Canadian Laramie and Belly River Series.

E. FROM THE "LOWER DARK SHALES" OF DR. DAWSON'S REPORT.

These are obviously Cretaceous but their exact horizon in the upper division of that formation has not yet been ascertained with much certainty.

Of the eleven species of fossils which have so far been collected from them, seven or eight seem to be identical with forms that are elsewhere regarded as characteristic of the Fort Pierre or Fox Hills Group, but the presence in these shales of *Scaphites Warreni*, var. *Wyomingensis*, and possibly of *Ostrea congesta*, may indicate that they occupy a slightly lower position in the series.

Dr. Dawson states* that on the Milk River, at the mouth of Pā-kow-kī Coulée these shales undoubtedly and directly underlie the yellowish beds of the Belly River Series.

LAMELLIBRANCHIATA.

OSTREA CONGESTA, Conrad.

Ostrea congesta, Conrad. 1843. Nicollet's Rep. of Expl. in the Northwest, p. 167.
" " Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. VIII. (n. s.), p. 405.
" " Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 286.
" " Hall. 1856. Pacific R. R. Reports, vol. III., p. 100, pl. 1, fig. 11.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 13, pl. 9, figs. 1, a, b, c, d, e, f.

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: a few exfoliated and badly preserved valves on two small slabs of limestone.

West flank of West Butte, Montana, in the Sweet Grass Hills and close to the international boundary line, G. M. Dawson, 1881: one perfect under valve, attached by its whole lower surface to a fragment of the outer layer of the test of a large *Inoceramus*.

These specimens are for the most part too imperfect to be identified with much certainty, though they agree very well with Meek's description of *O. congesta*, and appear to be essentially similar to the fossils from the Pembina Escarpment which Dr. Dawson has referred to that species on page 79 of his British North American Boundary Commission Report.

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* Geol. and Nat. Hist. Surv. Canada, Rep. Progress, 1882-83-84,—Report on the Region in the Vicinity of the Bow and Belly Rivers, N. W. T., p. 117c.

PTERIA (OXYTOMA) NEBRASCANA, Evans and Shumard.

Avicula Nebrascana, Evans and Shumard. 1857. Trans. Ac. Sc. St. Louis, vol. I. p. 38.
" " Meek. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., Toronto, p. 183, pl. 1, fig. 7.
Pteria (Oxytoma) Nebrascana, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 34, pl. 16, figs. 3 a, b, and pl. 28, fig. 11.

Rocky Spring Ridge, near MacLeod Benton Trail; Milk River, about three miles west of crossing of MacLeod Benton Trail; and west flank of West Butte, Montana, in the Sweet Grass Hills, near to the international boundary line; G. M. Dawson, 1881: a few recognizable specimens from each of these localities.

NUCULA CANCELLATA, Meek and Hayden.

Nucula cancellata, Meek & Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 85.
" " Meek. 1876. Rep. Geol. Surv. Terr., vol. IX, p. 102, pl. 28, figs 13 a, b, c, d, e.

Milk River, at the mouth of Pă-kow-kī Coulée, and Milk River, four miles east of the crossing of MacLeod Benton Trail, G. M. Dawson, 1881: apparently common at both of these places. The specimens are precisely similar both in shape and sculpture to the beautiful fossil mentioned on pages 37-38.

MACTRA (CYMBOPHORA) GRACILIS, Meek and Hayden.

Mactra gracilis, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.
Mactra (Cymbophora) gracilis, Meek. 1876. Rep. U. S. Geol. Surv. Terr IX, p. 209, pl. 17, figs. 18, a, b.

Milk River, at the mouth of Pă-kow-kī Coulée, G. M. Dawson, 1881: one very imperfect specimen with only small fragments of the test preserved.

LIOPISTHA (CYMELLA) UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 81.

Liopistha (*Cymella*) *undata*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

Milk River, four miles east of MacLeod Benton Trail, G. M. Dawson, 1881: five well characterized specimens.

CORBULA PERUNDATA? Meek and Hayden:

Corbula perundata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, p. 116.

" " Meek. 1876. Rev. U. S. Geol. Surv. Terr., vol. IX., p. 530, pl. 40, figs. 4 a, b, c, d. Figured also on plate 19, figs. 16 and 17, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am.

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: a badly preserved right valve which is somewhat doubtfully referred to this species.

CORBULAMELLA GREGARIA, Meek & Hayden.

Corbula? yregaria, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 84.

Corbulamella gregaria, Meek & Hayden. 1857. Ib., vol. IX., p. 143.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 247, pl. 17, figs. 13, a, b, c, d.

West flank of West Butte, Montana, in the Sweet Grass Hills, near the international boundary line, G. M. Dawson, 1881: a number of perfect specimens crowded together in a small hand specimen of rock. It is only upon the weathered outward surface of the rock, however, that the outlines of the united valves can be clearly made out, and the characters of the interior of the latter are entirely unknown.

GASTEROPODA.

ENTALIS PAUPERCULA, Meek and Hayden.

Dentalium pauperculum, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 178.

Entalis ? paupercula, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 269, pl. 18, fig. 14.

Milk River. at the mouth of Pā-kow-kī Coulée, G. M. Dawson, 1881: one specimen.

Since the pages in which the fossils of the Fox Hills and Fort Pierre Groups are enumerated were printed, a few specimens of a smooth *Dentalium* which is probably also referable to *Entalis paupercula* were obtained from rocks which represent one or other of these horizons, by breaking up small pieces of limestone collected by R. G. McConnell in 1884 at Old Wives Creek, Township 10, Range 11, west of the 3rd Principal Meridian.

PYRIFUSUS NEWBERRYI, Meek and Hayden.

Fusus Newberryi, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 66.

Fusus (*Pyrifusus ?*) *Newberryi*, Meek and Hayden. *Ib.*, vol. XII., p. 421.

Pyrifusus (*Neptunella*) *Newberryi*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 346, pl. 31, figs. 6, a, b, c, d, e, f.

West flank of West Butte, Montana, in the Sweet Grass Hills, and near the Forty-ninth Parallel, G. M. Dawson, 1874, (H. M. North American Boundary Commission) and 1881: one adult but not very well preserved specimen and two or three immature ones.

CEPHALOPODA.

BACULITES ASPER, Morton.

Baculites asper, Morton. 1834. Synopsis Org. Rem. Cret. Gr. U. S., p. 43, pl. 1, figs. 12 and 13; and pl. 13, fig. 2. Gabb. 1860. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 394, pl. 3, fig. 4.

Baculites asperoides, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 421 (without description).

Baculites asper, Morton? Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 404, pl. 39, figs. 10 a, d (not b, c).

Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881; apparently rather abundant. West flank of West Butte, Montana, but close to the Forty-ninth Parallel, G. M. Dawson, 1881.

These fossils evidently belong to the same species as those from Montana which Mr. Meek referred doubtfully to the *B. asper* of Morton. The most perfect of the specimens collected by Dr. Dawson is slender, with an ovate section, and measures about five inches and a half in length. It tapers very gradually and, as Mr. Meek observes, "is ornamented on each side, near the antisiphonal margin, both on the septate and non-septate portions, by a row of rather distantly separated, node-like prominences, that show the faintest perceivable tendency to extend obliquely forward and toward the siphonal side, as undulations, parallel to the lines of growth."

SCAPHITES WARRENI, Meek and Haydon.

Scaphites Warreni. Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 117; and *Ib.*, p. 420.

" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 420, pl. 6, fig. 5, and wood cuts, figs. 61, 62 and 63 on p. 421.

West flank of West Butte, Montana, near the Forty-ninth Parallel, G. M. Dawson, 1881: abundant but usually imperfect and badly preserved. One of the specimens from this locality, however, is nearly perfect and corresponds almost perfectly with Meek's figures of the variety *Wyomingensis*, and two others although immature are well preserved and very little broken. Rocky Spring Ridge, near MacLeod Benton Trail, G. M. Dawson, 1881: four specimens.

F. EXACT GEOLOGICAL HORIZON UNCERTAIN.

"The species included under this general title are from several localities in the Foot-Hills and Rocky Mountains where the beds are much disturbed, and as the sections have not yet been worked out in detail there is no satisfactory stratigraphical evidence as to the positions which these deposits occupy in the series." G. M. Dawson. With the exception of the first-named, which is possibly from the Laramie Formation, the whole of the species are undoubtedly Cretaceous.

LAMELLIBRANCHIATA.

OSTREA SUBTRIGONALIS, Evans and Shumard.

Ostrea subtrigonalis, Meek. 1876. (But doubtfully as of E. and S.) Rep. U. S. Geol. Surv. Terr., vol. IX., p. 510, pl. 40, figs. 1, a, b, c, d. Figured also on pl. 12, figs. 2-5, of Dr. C. A. White's Rev. Non-Marine Foss. Moll. N. Am., Washington, 1883.

Middle Fork of the Old Man River, about two miles above the mouth of the North Fork, G. M. Dawson, 1883: a number of specimens of the shell of a small oyster which appear to be referable to this species.

These shells are not quite as typical forms of *O. subtrigonalis* as those from the Belly River indicated under that name on page 30, and some have very much the appearance of small examples of *Ostrea glabra*, especially of the variety *arcuatilis*, Meek. It may be that both species are represented at the locality first mentioned.

OSTREA CONGESTA, Conrad.

Ostreà congesta, Conrad. 1843. Nicollet's Rep. of Expl. in the Northwest, p. 167.
" " Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. VIII. (n. s.), p. 405.
" " Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., p. 286.
" " Hall. 1856. Pacific R. R. Reports, vol. III., p. 100, pl. 1, fig. 11.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 13, pl. 9, figs. 1, a, b, c, d, e, f.

Waterton River, a few miles below the lake, G. M. Dawson, 1881: about half a dozen badly preserved specimens.

PINNA LAKESII, White.

Pinna lakesii, White. 1879. Rep. U. S. Geol. Surv. Terr. for 1877, p. 181.
" " " 1880. U. S. Geol. Surv., Contr. to Pal., Nos. 2-8, p. 17, pl. 11, figs. 1a and b.

South branch of the South Fork of the Old Man River, G. M. Dawson, 1883: one very well preserved but not quite perfect cast of the interior of the closed valves.

VOLVICERAMUS EXOGYROIDES, Meek and Hayden. (Sp.)

Inoceramus exogyroides, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 26.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 46, pl. 5, figs. 3, a, b, c.

South branch of Drywood Fork, Waterton River, G. M. Dawson, 1881: a cast of the interior of a rather small specimen of the left or convex valve (the only valve known), with large portions of the somewhat thick test preserved. Entrance to North Kootanie Pass (from shales), G. M. Dawson, 1883: a larger cast of the interior of the left valve, but with not a fragment of the test remaining.

INOCERRAMUS UNDABUNDUS, Meek and Hayden.

Inoceramus undabundus, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 26.
" " Meek. 1876. Rep. U. S. Surv. Terr., vol. IX., p. 60, pl. 3, figs. 2, a, b.

Highwood River, ten miles west of the first fork, R. G. McConnell, 1882: two very large but not quite perfect single valves, in a dark or blackish shale. North-West branch of North Fork of the Old Man River, about four miles below the mouth of Oyster Creek, in a thick band of dark shale; G. M. Dawson, 1883: one small but nearly perfect left valve.

INOCERAMUS PROBLEMATICUS, Schlotheim.

Ostracites labiatus, Schlotheim. 1813. Bronn's Jahrbuch, vol. VII., p. 93.
Mytilites problematicus, Schlotheim. 1820. Petræfactenk., vol. I, p. 302.
Mytiloides labiatus, Brongniart. 1822. Cuv. Oss. foss., pl. 3, fig. 4, in Geol. des env. de Paris.
Inoceramus mytiloides, Mantell. 1822. Geol. of Sussex, p. 215, pl. 27, fig. 2, and pl. 28, fig. 2.
" " Sowerby. 1823. Min. Conch., vol. V, p. 62, pl. 442.
" " Goldfuss. 1836. Petræfact. Germ., vol. II., p. 188, pl. 113, fig. 4.
Inoceramus problematicus, d'Orbigny, 1843. Pal. Franc., Terr., Cret., vol. III., p. 510, pl. 406. Meek and Hayden, 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 119.
? *Inoceramus pseudomytiloides*, Schiel. 1855. Pacific Railway Reports, vol. II., p. 108, pl. 3, fig. 8.
Inoceramus labiatus, Stoliczka. 1871. Pal. Indica, vol. III., Cret. Pelecyp. S. India., p. 408, pl. 29, fig. 1.
Inoceramus problematicus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol IX, p. 62, pl. 9, figs. 3, a, b.

Mill Creek, at mill west of Fort McLeod, in thin pieces of brittle and fissile shale, G. M. Dawson, 1881, and T C. Weston, 1883: a few perfect but flattened single valves. Dr. Dawson informs the writer that these *Inocerami* from Mill Creek come from a band of dark shales in the disturbed foot hill region. These shales, however, immediately overlie or underlie a series of sandstones which hold plants apparently identical with those of the Dakota Group. It is probably in the continuation of the same band of shales that the fossils from the entrance to the North Kootamie Pass came.

Characteristic specimen of the typical *I. problematicus* have also been recognized in pieces of a drab or yellow-grey limestone collected by Mr. J. W. Spencer in 1874 on the Swan River, N. W. T.

PHOLADOMYA PAPYRACEA, Meek and Hayden.

Pholadomya papyracea, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 27.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 217, pl. 5, figs. 4, a, b.

North West branch of North Fork of the Old Man River, about four miles below the mouth of Oyster Creek, G. M. Dawson, 1883: one specimen.

CEPHALOPODA.

SCAPHITES WARRENI, Meek and Hayden.

Scaphites Warreni, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p.p. 177 and 420.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 420, pl. 6, fig. 5.

Highwood River, ten miles west of first fork, R. G. McConnell, 1882: four fine specimens of an unusually large form of the species, the largest of which measures nearly three inches in length, in the direction of the longer axis of the ellipse, by about one inch and a half in its greatest lateral diameter. Entrance to North Kootanie Pass, G. M. Dawson, 1883: one specimen. North West branch of North Fork of the Old Man River, about four miles below Oyster Creek, G. M. Dawson, 1883: an imperfect but large and very ventricose specimen, which is nearly two inches broad although no part of the deflected portion is preserved.

SCAPHITES VERMIFORMIS? Meek and Hayden.

Scaphites vermiformis, Meek and Hayden. 1862. Proc. Ac. Nat. Sc. Phil., vol. XIV., p. 22.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 423, pl. 6, figs. 4, a, b.

North West branch of North Fork of the Old Man River, G. M. Dawson, 1883: two nearly perfect specimens and two fragments. Entrance to the North Kootanie Pass, G. M. Dawson, 1882: several large fragments.

These specimens appear to differ from those from the same localities which are here referred to *S. Warreni*, in having the deflected portion much shorter, and in their coarser ribs, the larger ones of which usually (though not invariably) bear a row of rather prominent nodes on the outer half of each side. These nodes, however, are frequently not developed, and it may be that the shells now under consideration should be regarded as only a coarsely ribbed variety of *S. Warreni*.

CRUSTACEA.

HOPLOPARIA ? CANADENSIS, Whiteaves.

Plate 11.

Hoploparia ? Canadensis, Whiteaves. 1884. Proc. and Trans. Royal Soc. Canada, vol. 2, p. 237.

Highwood River (a tributary of the Bow River), ten miles west of the first fork, R. G. McConnell, 1882: one specimen.

The following is a copy of the original description of this interesting fossil.

"The specimen originally consisted of an elongate-oval and flattened concretionary nodule of soft argillite, with a small piece broken off from one end, but enough of the matrix has been removed to show most of the carapace and the upper surface of a few of the abdominal segments. The anterior extremity of the carapace, with the rostrum, is unfortunately not preserved, and the tail, with some of the posterior abdominal segments, was broken off when the nodule was found. The ambulatory feet are preserved, but it was found to be scarcely possible to remove the soft shale from around them without running the risk of spoiling the specimen.

The carapace, like that of most of the macrura, is elongated and comparatively narrow, with nearly parallel sides, and, when perfect, its length must have been about twice as great as its breadth. A little in advance of the midlength a single, broadly V-shaped, deep and rather wide groove or furrow crosses the carapace transversely. The posterior half of the carapace is depressed and rather distinctly three-keeled in a longitudinal direction, though it is most likely that these appearances are mostly or wholly due to a considerable and abnormal compression from above. Be this as it may, in the specimen collected by Mr. McConnell, a central keel, or narrow but prominent raised ridge, which is about three times as broad posteriorly as it is anteriorly, and which is bounded on each side by a deep and angular furrow, extends from the posterior end of the carapace to the centre of the V-shaped groove which transverses it. This central keel is much more strongly marked than the broad and comparatively obtuse and lateral keels, which latter are placed near the outer margin of each side. The surface of the posterior half of the carapace (and perhaps that of the anterior also) is covered with rather distant, small, isolated conical tubercles, which, under the lens, look as if they might have each borne a bristle at the summit, and which, occasionally, are surrounded by a minute annulus at the base; and the three keels each have a single series of larger conical tubercles, whose pointed apices are directed forward.

In front of the transverse and V-shaped furrow the carapace is very badly preserved, and the anterior margin with the rostrum is broken off. The two lateral and tuberculated keels appear to be prolonged to within a short distance of the front margin of the carapace, though they are somewhat less distinct in front of the transverse furrow than they are behind it. On the anterior side of the furrow the central keel is absent, and the median portion of this part of the carapace bears a number of comparatively large and prominent, distinct and conical tubercles, which are somewhat peculiarly arranged. Next to the furrow, and in advance of it, in the median line, there are five tubercles arranged in two convergent rows of two pairs and an odd one, which, if connected by lines, would have much the shape of an isosceles triangle, witn its base near to the furrow. Between the space bounded by these five tubercles and each lateral keel, there is a shallowly concave and rather broad depression of the carapace. In front of these five tubercles, again, there are four others and still larger ones (the two anterior ones apparently of considerable size), arranged somewhat in the form of a square, any of whose sides would be greater than the base of the isosceles triangle indicated by the other five.

The upper surface of each of the abdominal segments bears a tubercle in the centre, on its anterior edge, and another one on the margin of each of the sides. The most prominent characteristic of the species, in fact, is the possession of three widely distant, longitudinal and tuberculated keels, which extend over nearly the whole length of the upper surface of the body.

To the right of the carapace, in front, there are indications of what appears to have been a large pinching claw, and, if the appearances presented are correctly interpreted, the sides of the fixed ramus of that claw are also coarsely tuberculated.

Until its exact generic position shall have been settled by the collection of more perfect specimens, it may be convenient to designate the present species as *Hoploparia* (?) *Canadensis*, though it is by no means certain that it belongs to McCoy's genus of that name."

Judging by the invertebrate fossils alone, it would seem probable that the friable and fissile shales at Mill Creek which hold typical example of *Inoceramus problematicus* may represent the "Niobrara

Group" of the Upper Missouri Section. On similar evidence, also, the rocks at the two localities on the Waterton River which have yielded respectively *Ostrea congesta* and *Volviceramus exogyroides;* those at the Highwood River which contain *Inoceramus undabundus* and *Scaphites Warreni;* those on the Northwest branch of the North fork of the Old Man River from which *Inoceramus undabundus, Pholadomya papyracea, Scaphites Warreni* and *S. vermiformis* were collected; and those at the entrance to the North Kootanie Pass which are characterized by *Volviceramus exogyroides, Scaphites Warreni* and *S. vermiformis,*—would appear to be as nearly as possible the Canadian equivalents of the "Fort Benton Group."

In conclusion, it may be remarked that (as already partly stated in the foot-note to page 55) the invertebrate fauna of the "Belly River Series" seems to be essentially the same as that of the "Laramie" of the United States and Canada, unless more than one formation has been confounded under the latter name, and that it is at present scarcely possible to separate the "Lower Dark Shales" of Dr. Dawson's Bow and Belly River Report from the "Fort Pierre and Fox Hills" Groups, on purely palæontological grounds.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS
TO
CANADIAN PALÆONTOLOGY.

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART II.

2. *On some fossils from the Hamilton Formation of Ontario, with a list of the species at present known from that formation and province.*
3. *The fossils of the Triassic Rocks of British Columbia.*
4. *On some Cretaceous fossils from British Columbia, the North West Territory and Manitoba.*

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The Second Part of the "Contributions to Canadian Palæontology" consists of three separate papers, on more or less widely different subjects.

No. 2 is "on some fossils of the Hamilton Group of Ontario, with a list of the species at present known from that formation and province;" No. 3 is an enumeration or description, as the case may be, of the fossils of the Triassic Rocks of British Columbia; while No. 4 is "on some Cretaceous fossils from British Columbia, the North-West Territory and Manitoba."

Advances copies of the letter press of pages 91–122 were issued in September, 1887, pages 123–150 were issued in December, 1888, pages 181–184 in June, 1889, while the remainder, or pages 185–196, will bear date herewith.

The Part complete, as now presented, consists of 107 pages of text, illustrated by fifteen full page plates, lithographed by Messrs. Mortimer & Co., of Ottawa, from original drawings made by Mr. L. M. Lambe, the artist to the Survey.

ALFRED R. C. SELWYN.

GEOLOGICAL AND NATURAL HISTORY SURVEY OFFICE,
OTTAWA, Aug. 1, 1889.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

2. *On some fossils from the Hamilton Formation of Ontario, with a list of the species at present known from that formation and province.*

The calcareous shales and limestones of the Hamilton Formation of the Middle Devonian System in western Ontario have long possessed a special interest to palæontologists, on account of the variety and excellent state of preservation of the fossils which they contain.

A succinct account of the first recognition of the exact geological horizon of this group of rocks is given by Mr. Alexander Murray on pages 129-182 of the "Report of Progress of the Geological Survey of Canada for 1853-54-55-56," published in 1857, and their distribution in Ontario is described more in detail in the fifteenth chapter of the "Geology of Canada" (1863) and in Professor Chapman's "Outlines of the Geology of Canada" published in 1876.

According to the writer last mentioned, "the formation in this district is estimated at about 250 feet in thickness. It extends across the counties of Norfolk, Elgin, Kent, Middlesex and Lambton, and also the south part of Huron, but is much obscured throughout this area by overlying clays, sands and other drift and superficial deposits. The best exposures occur in the township of Bosanquet, in the north-west corner of Lambton." To this it may be added that extensive and richly fossiliferous outcrops occur on both banks of the Sable River, in the adjacent township of West Williams, county of Middlesex, near Bartlett's Mills, that Widder and Thedford are both in the township of Bosanquet, and that the name of the station on the Grand Trunk Railway which was formerly called Widder has been changed to Thedford, the two villages of that name being only one mile and a half apart.

Most of the fossils that have been recorded from these rocks in Ontario are enumerated or described in two papers by the late Mr. E. Billings, and in two reports by Professor H. Alleyne Nicholson.

In Mr. Billings paper "On the Fossil Corals of the Devonian rocks of Canada West," published in the Canadian Journal for March 1859, two species, viz.: *Heliophyllum Halli* of Edwards and Haime and *H. tenui-*

September, 1887.

septatum, Billings, are enumerated as occurring in the Hamilton Formation, the latter being then described for the first time. To these should probably be added the *Cystiphyllum Americanum* of Edwards and Haime, which is one of the commonest fossils of this formation, although by some inadvertence Mr. Billings omitted to state from what particular horizon the specimens he referred to were obtained.

In another paper by Mr. Billings, "On the Devonian Fossils of Canada West," published in the Canadian Journal for May 1860, nine species of corals, six of which had not previously been described, and fifteen of brachiopoda, two which were here named and characterized for the first time, are enumerated as having been collected in the Hamilton Formation.

Professor H. A. Nicholson's "Report upon the Palæontology of the Province of Ontario," published at Toronto in 1874, which is exclusively devoted to the organic remains of the Devonian rocks, contains the most exhaustive and indeed the only list that had appeared up to that date of the fossils of the Corniferous and Hamilton Formations of that province. The number of species from the latter formation enumerated in this list is fifty-six, many of which were described for the first time in this report, but seventeen out of the fifty-six are identical with forms that had previously been recorded by Mr. Billings as occurring in the same formation.

In his Report upon the Palæontology of the Province of Ontario, published at Toronto in 1875, Professor Nicholson adds fifteen species to the fauna of the Hamilton Formation of that province, two out of the seventeen there mentioned as belonging to it having been previously recognized or described by Mr. Billings.

Due allowance being made for names that are mentioned by both of these palæontologists, the total number of species recorded in these four publications from the formation and province in question is eighty-one, and since 1875 about twenty additional species have been described or identified by E. Billings, Drs. Nicholson, Carl Rominger and G. J. Hinde, Prof. H. Montgomery and Messrs. Etheridge and Carpenter, thus bringing the general total, to the close of 1886, up to a little over one hundred.

In addition to these the Museum of the Geological Survey of Canada contains nearly forty species of fossils, most of which have not previously been recognized as occurring in the Hamilton Formation of Ontario, or at least not in any Canadian publication. With the exception of *Spirifera subdecussata* and *Dalmanites Helena*, they are all from the townships of Bosanquet or West Williams, and a few of them appear to be undescribed. Some of these fossils were collected by Mr. James Richardson in 1859 and by Mr. Johnson Pettit in 1868, but by far the greater number were obtained by the Rev. Hector Currie (formerly of Widder and now resident at Thedford) and by the Rev. J. M. Goodwillie, two zealous and successful collectors of the fossils of these townships since 1876, who generously presented a number of their choicest specimens to the Museum of the Canadian Survey in 1882.

The object of the present paper is to place upon record the names of these and other fossils new to the published lists, with descriptions and figures of such as appear to be undescribed, and finally to give as complete a list as possible of all the species known up to the present date from the formation in Ontario.

In the preparation of this paper the writer desires to acknowledge his obligations to Mr. Charles Wachsmuth for the identification of three species of crinoids, as well as for valuable critical suggestions in reference to the crinoids and blastoids generally; to Professor James Hall for the loan of two of the types each of his *Pentremites leda and P. Whitei*; and to Professor R. P. Whitfield for the loan of one of the types of *Nucleocrinus lucina*, Hall, now in the American Museum of Natural History in New York city, and for the comparison of Canadian specimens supposed to be referable to *Nucleocrinus elegans*, Conrad, and *Productella truncata*, Hall, with the types of those species in the same institution.

CŒLENTERATA.

ANTHOZOA.

(Tetracoralla, Hæckel: Rugosa, Edwards and Haime.)

ACERVULARIA PROFUNDA, Hall.

Acervularia profunda, Hall. 1758. Rep. Geol. Surv. St. Iowa, vol. I., pt. 2, p. 477, pl. 1, figs. 7 a, b, c.

Township of Bosanquet, Mr. J. Pettit, 1868 : one fine specimen.

Dr. Rominger, in his "Fossil Corals of Michigan," (p. 106) expresses the opinion that *A. profunda* is only a variety of *A. Davidsoni*, Edwards and Haime, and that *Acervularia* itself is synonymous with *Cyathophyllum.*

ECHINODERMATA.

CRINOIDEA.

TAXOCRINUS LOBATUS, Hall, var.

Plate 12, fig. 1.

Forbesiocrinus lobatus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 124.
Taxocrinus lobatus, Wachsmuth and Springer. 1879. Rev. Palæocrinoidea, pt. 1, p. 49.
" " Miller. 1883. Cat. Am. Pal. Foss., Second Ed., p. 288.

Plates of the "dorsal cup" and arms of apparently the same shape, number, and disposition as those of the type of *T. lobatus*, but the bifurcating plates or third radials of the Canadian variety are destitute of nodes, and the entire surface appears to be smooth rather than "finely granulose." This latter circumstance, however, may be due to a slight weathering of the specimens.

Near Thedford, Rev. Hector Currie, two specimens: one collected in 1882 and the other in 1883.

These two fossils are regarded with some doubt as a local variety of *Taxocrinus lobatus*, principally upon the authority of Mr. Charles Wachsmuth who has examined and reports as follows upon them in a letter to the writer: "I have compared the two specimens with *Forbesiocrinus lobatus* and *F. nuntius*, Hall, which are both *Taxocrinus*. They differ from both of these species in having neither nodes nor spines upon their bifurcating plates. The nodes, however, might be undeveloped, as is the case sometimes in *Taxocrinus Thiemei*, and this is the more probable as the specimens agree in other respects with Hall's description of *Forbesiocrinus nuntius*. It is very curious that Hall, in his description of *Forbesiocrinus nuntius*, speaks of the very remarkable resemblance of this species to *F. Thiemei* and that in Vol. 2 of the Ohio Report, Pl. 12, fig. 2, a specimen which is almost identical with *Taxocrinus Thiemei* is called *Forbesiocrinus lobatus*, var. *tardus* and not *F. nuntius*, var. *tardus*, as it ought to be. I have compared your specimens also with *Taxocrinus Ithacensis*, Williams, with which they agree more closely than his figures on Plate 1 would suggest. I have good india rubber casts of his type specimens, and find in none of them the second primary radials so widely separated as in his figure. He describes all plates in a radial direction from the first primary radial up as brachials and arm plates, i. e. as free plates; while in fact his species, like all others of the genus, has not only three or more primary but also several secondary radials, connected laterally by interradials, though these latter, which were moveable in the animal, are rarely preserved in the fossil. *Taxocrinus Ithacensis* differs from your specimens in having less bifurcations and in possessing almost straight and not strongly waving sutures."

HOMOCRINUS CRASSUS. (N. Sp.)

Plate 12, fig. 2.

Calyx, or rather "dorsal cup," somewhat bell-shaped, rather broad and slightly inflated near the base and concavely as well as very shallowly constricted a little below the middle. Height of the dorsal cup, from the lower margin of the underbasals to the summit of the first radials, very little greater than its maximum breadth. Underbasals pentagonal, about one half the size of the basals, and broader than high: basals moderately large, about equal in size to the anterior radials, the three anterior ones hexagonal, the two posterior ones heptagonal and truncated above: inferior anal plate equal in size to the underbasals, square and resting obliquely between two basals, the right radial and the superior anal plate. Primary radials pentagonal, nearly flat below, slightly raised in the middle above, and truncated abruptly and somewhat obliquely, in such a manner as to form a shallowly excavated articulating area whose contour is almost circular, but a little broader than high, and which is furnished with a small, ovate, marginal foramen, whose acutely pointed apex opens directly into an obtusely angular notch in the centre of the upper margin of the plate. Right posterior radial a little smaller than the rest. Superior anal plate pentagonal, equal in size to the right posterior radial, but devoid of course of a distinct lateral articulating area. Substance of the plates thick: outer surface apparently smooth.

Near Thedford, Rev. Hector Currie, 1882: a single specimen of the dorsal cup, entirely free from the matrix.

This species may be easily distinguished from the *H. scoparius* of Hall, from the Lower Helderberg of the State of New York, and from the *H. proboscidialis* of Hall, from the Oriskany Sandstone of the same State, by its much larger size, by its broader, shorter and more bell-shaped dorsal cup, and by the much greater thickness of the plates of which this part of the calyx is composed.

ARTHROACANTHA PUNCTOBRACHIATA, Williams.

Plate 13, figs. 1, and 1a.

Arthroacantha punctobrachiata, H. S. Williams. 1883. Trans. Am. Phil. Soc., April, pp. 83 & 86.
Hystricrinus Carpenteri, Hinde. 1885. Annals and Mag. Nat. Hist., Ser. 5, vol. XV., p. 157.

Township of Bosanquet, Mr. J. Pettit, 1868: Bartlett's Mills, near Arkona, Rev. Hector Currie and Rev. J. M. Goodwillie, 1882, and H. M. Ami, 1883.

In the Museum of the Survey there are five good specimens of this species and there are two also in the Redpath Museum at Montreal. These latter were collected by the Rev. Hector Currie, and were kindly loaned to the present writer for examination and study, by Sir William Dawson. Of these seven specimens five have the whole of the calyx, with portions of the arms, beautifully preserved, but the summit of each is completely filled by a shell of *Platyceras dumosum*, Conrad, var. *rarispinum*, Hall. The perforated tubercles to which the moveable spines were attached, are well shewn in each specimen and it is not unusual to find the spines lying alongside of the tubercles.

In 1883 Prof. H. S. Williams published a description of a new genus of crinoids for which he proposed the name *Arthroacantha.* This genus was shewn to be most nearly related to *Hexacrinus*, Austin, but to differ therefrom in "possessing a well defined third primary radial similar in size to the second, and from which the free arms abruptly diverge," and from it and "from all other hitherto undescribed crinoids, in the possession of slender, acicular spines which were free from the plates and were evidently articulated by some means upon elevated pitted tubercles on the surface of the calyx, vault and free arms." The type of this genus was stated to be the *A. Ithacensis* (Williams) "from the base of the Chemung Group at Ithaca, N. Y.," and this species was described in minute detail, with full measurements of all the parts known, and illustrated with an octavo plate of eight figures.

On page 83 of the paper in which the genus *Arthroacantha* was described by Professor Williams the following remarks occur. "In studying this genus, I have examined several specimens which agree with the typical form in the general character of the plates and the arms in one case, and possess the pitted tubercles on the surface. The most important among these is the original specimen of a figure issued by the New York State Museum with the name *Platycrinus ? punctobrachiatus.* The original is in the Museum of Cornell University. The name was proposed by Prof. Hall, but, as he informs me, the species was never described. This, with several other undescribed species, was photographed and the plate was privately distributed about 1872, with name attached, but with no descriptions. The arms, the shape of calyx, and the plates that were preserved, correspond in general with *A. Ithacensis*, but the tubercles on the calyx plates are finer, more numerous, and the pitting very indistinct, and the basal plates are relatively larger than in the typical specimens of that species. Hence we are led to believe that the Hamilton species is distinct from the Chemung specimens, and even if it were properly described and published, it is probably safe to regard it as a distinct species. Although the specimen shows no traces of the free spines, the nature of the tubercles leave little doubt of a generic identity with *Arthroacantha Ithacensis*, and the Hamilton form may be called *Arthroacantha punctobrachiata*. In the Museum of Cornell University are two specimens, each a portion of the basal disc, which appear to be identical with *A. punctobrachiata*. One is marked *Moscow shale*, locality not designated; the other is marked *Hamilton Period, Delphi, N.Y.* and is on a soft dark shale with specimens of *Pholidops*."

On page 86 of the same paper, in reference to *A. Ithacensis*, we read as follows: "This species differs from the *Arth. punctobrachiata* of the Hamilton group in the more distinct and less numerous tubercles on the surface of the calyx plates: the smaller size of the tubercles leads to the inference that the spines were smaller in the Hamilton form; the calyx plates were apparently thicker in the Chemung species, and the second and third radial of the specimen *Arth. punctobrachiata* are higher than those of *Arth. Ithacensis*."

The following year, on receipt of a copy of Professor Williams' paper, the present writer came to the conclusion that the specimens now under consideration were referable to *A. punctobrachiata*, Williams, first, because they are from the Hamilton Formation,—secondly, because they agree perfectly with Professor Williams' diagnosis of the characters of the genus,—and thirdly, because they differ from the *A. Ithacensis*, of the Chemung group, as figured by Williams, in having more numerous and less distinct tubercles on the surface of the calyx plates, with shorter and smaller spines articulated to these tubercles. A similar conclusion had previously been arrived at, on perfectly independent grounds, by Mr. Charles Wachmuth, to whom two of the Canadian specimens had been submitted.

In 1885 Dr. George Jennings Hinde published a paper entitled "Description of a New Species of Crinoids, with Articulating Spines," and to this species he gave the name *Hystricrinus Carpenteri*. The specimens upon which the paper was based were stated to be from the

Middle Devonian of Arkona, Ontario, and the locality, as well as the description and figures, leave little room for doubt that Dr. Hinde's specimens are both specifically and generically identical with those whose nomenclature is now being discussed. In this and in a subsequent paper Dr. Hinde claims that Professor Williams' genus *Arthroacantha* cannot be retained, because "the name *Arthracanthus* was employed by Schmarda in 1854 for a genus of Rotatoria," and that the species *Arthroacantha punctobrachiata* must also be rejected, because it was never properly described.

But to the first of these objections it may be answered that, although from a purist's standpoint, the *o* in *Arthroacantha* may be superfluous, yet the difference in the terminations of the two words in question is quite sufficient to admit of the use of both. Generic terms which differ only in this respect, such as, for example, *Picus*, a woodpecker, and *Pica*, a magpie—*Cyprinus*, a carp, and *Cyprina*, a mollusk—and many such instances could be cited, are in universal use among biologists at the present day, with no inconvenience resulting therefrom. In reply to Dr. Hinde's second contention, viz., that the *A. punctobrachiata* has never been properly described, the whole of the original description of that species has already been quoted, so that the reader, on this point, can form his own opinion. In the writer's judgment, however, the distinctive characters given by Prof. Williams, though largely negative and unaccompanied with any figures, are yet sufficiently explicit to allow of the recognition of the species, and if this be the case, the laws of nomenclature would seem to require that his name should be adopted.

DOLATOCRINUS LIRATUS, Hall.

Cacabocrinus liratus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 139.
Dolatocrinus liratus, S. A. Miller. 1877. Cat. Am. Pal. Foss. p. 77.
" " Wachsmuth and Springer. 1881. Rev. Palæocrinoidea, pt. 2, p. 126.

Bartlett's Mills, near Arkona, Rev. J. M. Goodwillie, 1882: one good specimen, which appears to belong to this species, although, as pointed out by Mr. Wachsmuth, it has only 1 x 2 secondary radials (brachials, Hall) while the type of *D. liratus* is said to have 2 x 2. The generic and specific characters of this specimen and of the beautiful example of *Ollacrinus spinigerus* collected by the Rev. Hector Currie, were first recognized by Mr. H. M. Ami.

DOLATOCRINUS LAMELLOSUS, Hall.

Cacabocrinus lamellosus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 141.
Dolatocrinus lamellosus, S. A. Miller. 1877. Cat. Am. Pal. Foss., p. 77.
" " Wachsmuth and Springer. 1881. Rev. Palæocrinoidea, pt. 2, p. 126.

Near Thedford, Rev. Hector Currie, 1882, *teste* Wachsmuth: one nearly perfect and tolerably well preserved but somewhat crushed example of the calyx.

DOLATOCRINUS CANADENSIS. (N. Sp.)

Plate 12, figs. 3, 3 a, 3 b, and 3 c.

Calyx rather small, sub-hemispherical, much broader than high: "dorsal cup" broadly and shallowly basin-shaped but deeply concave in the centre exteriorly: dome moderately elevated, rather distinctly pentalobate as viewed from above, the radial areas being slightly raised and the interradial as slightly depressed.

United basals small and forming a funnel-shaped concavity for the reception of the column.

First primary radials hexagonal, broader than high and broadest above the middle,—almost completely sunk in the basal concavity. Second primary radials quadrangular, much broader than high, rather smaller than the first and unlike them forming part of the lateral wall of the calyx. Third primary radials pentagonal, much broader than high and a little broader than the second. On the upper sloping sides of each third primary radial, there is a similarly shaped but much smaller pair of secondary radials, or radials of the second order. On its two upper sides each secondary radial to the right bears a pair of still smaller tertiary radials while each one on the left bears a single tertiary radial on its inner and upper side. These three tertiary radials are quadrangular or subquadrangular in outline, but their upper margins are obliquely bevelled off and deeply emarginate in the centre, in such a way as to form articulating bases, or portions of bases, of attachment for the arms. In every ray, therefore, there were originally three arms, two on the right side and one on the left, though the arms themselves do not happen to be preserved in the only specimen known to the writer.

Interradials two: the first rather larger than the first primary radials, subovoid and truncated above, or obscurely nine-sided with the upper side much the broadest, resting against the sides of the second and third primary radials, and about equal in height to both of the latter. Second interradials much smaller than the first, about twice as broad as high, hexagonal (or possibly quadrangular) in outline. Above each of the second interradials there are three plates, the central one pentagonal and broader than high, with a minute and apparently hexagonal plate, which is higher than broad, on each side of it. These three plates are in each case placed between the arm bases of two contiguous rays.

Dome plates polygonal, varying in shape and size according to their relative position, some of those in the interradial areas being slightly larger than any of those in the radial. Anal aperture nearly but not quite central.

The sculpture of the outer surface of the plates of the dorsal cup consists of numerous raised ridges which radiate from a large and prominent tubercle in the centre of each plate. In the radial series the first, second and third primary radials are connected by a continuous ridge, which is broader and more prominent than any of the other radiating ridges in these plates, and this bifurcates, in the centre of each third primary radial, into two branches which diverge outwards and upwards through the secondary radials as far as the commencement of the arm bases below. In the interradial series, a ridge which is also broader and more prominent than the other radiating ridges, commences in the middle of the lower margin of each of the first primary interradials and extends upwards as far as the central tubercle. From this point it bifurcates widely outward and upward until the extremity of each of its branches reaches nearly as far as and almost coalesces with that of the corresponding branch in the nearest secondary radial.

The outer surface of the dome plates is very minutely granulose and ornamented, with but few exceptions, by minute, low, isolated and rounded tubercles, of which there are from one to six in each plate.

Maximum height of the only specimen known, about thirteen and a half millimetres; greatest breadth of the same, nineteen mm. and a half.

Near Thedford, Rev. J. M. Goodwillie, 1882: a single specimen.

This species appears to be most nearly related to *Dolatocrinus triadactylus* of Barris, from the Hamilton Formation of Alpena, Michigan.* Mr. Wachsmuth, who has kindly compared the type of *D. Canadensis* with authentic examples of *D. triadactylus*, in a letter to the writer states that the latter "has the same general form and the same arm formula, but the basals are less deep and have around the column, at a level with the lower plane of the calyx, a prominent rim, and its ornamentation consists of numerous ridges arranged in triangles *without* tubercles, and these outer ones enclose two smaller triangles."

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* Described and figured in the "Proceedings of the Davenport Academy of Natural Sciences" for 1883.

COLUMNS OF DOLATOCRINUS.

Plate 12, figs 4, 4a.

Portions of the column of one or more species of *Dolatocrinus* were collected by Mr. J. Pettit, in 1868, in the shales of the Hamilton Group of the township of Bosanquet.

These consist of groups of from two to ten or more joints, which are circular in outline and depressed at the sutures, which are sometimes minutely crenulated. In the centre of each of these groups, and superimposed upon two or three joints, there is a prominent but still rather narrow ring, which at equal distances apart bears three laminar expansions, which are flattened at a right angle to the joints on which they are placed, but in a direction parallel to the axis of the column. These laminar expansions are triangular in outline, in the only specimen in which their margin is unbroken, their bases are as broad as the cluster of joints of the column of which they form a part is high, and they project from it to a distance of as far as six millimetres. The central canal is very large and circular in outline.

MEGISTOCRINUS RUGOSUS, Lyon and Casseday.

Megistocrinus rugosus, Lyon and Casseday. 1859. Am. Journ. of Sc. and Arts, Vol. xxviii, p. 243.

Near Thedford, Rev. J. M. Goodwillie, 1882: one specimen, which has been identified with this species by Mr. Charles Wachsmuth.

MEGISTOCRINUS, SP. INDT.

Plate 13, figs. 2, 2a, 2b.

A specimen which Mr. Wachsmuth thinks is probably the central dome plate of a large *Megistocrinus*, was collected by the Rev. Hector

Currie, near Thedford, in 1882. At the same locality and date two other and similar specimens were obtained by Mr. Currie, but the original of figures of 2, 2a and 2b on Plate 13 is the only one that the writer has seen.

Its dimensions are: height, fourteen millimetres; maximum breadth, sixteen mm.; breadth at base, eight.

As viewed in one direction its outline is somewhat hatchet-shaped with a truncated base, while, as viewed in the opposite direction, its outline is wedge-shaped with the sides slightly convex. The centre of the base is rather deeply excavated and surrounded by a single row of concave and somewhat oblique facets. From one point of view the plate broadens rapidly from the base upwards about as far as the middle, and its upper margin is semicircular, while, from another (at nearly a right angle to the first) it narrows rapidly from below upwards and outwards into a thin and sharp edge.

To the naked eye the surface of the plate seems smooth, but when examined under a lens the base is seen to be minutely granulose and the sides and edge minutely corrugated in a longitudinal direction, though one of the flattened sides seems to be much less distinctly corrugated than the other.

SPINE OF DOME OF CRINOID. (Genus and species unknown.)

Plate 13, figs. 3, 3a.

The curious flask-shaped body represented on Plate 13, which is evidently a spine from the dome of some unknown crinoid, was also collected by the Rev. Hector Currie, at Thedford, in 1882, and presented by him to the Museum of the Survey.

Its apex is unfortunately broken off, but the part which is preserved is fourteen millimetres in length or height. The centre of the base is rather deeply excavated and surrounded by a single row or ring of eight oblique facets, some of which are faintly concave. Immediately above the base the spine is swollen into a rather narrow bulb-like expansion, whose maximum breadth is five millimetres, and above this it narrows gradually, the breadth at the broken summit being about two mm.

When viewed under a lens the facets which surround the central excavation of the base are seen to be minutely granulose, and the bulbous part of the spine is ornamented with irregular and longitudinally disposed, but somewhat twisted, thin and flat lamellar ridges, which are more or less broken up into low spines whose apices are directed upwards. Above the bulb the surface is minutely and longitudinally corrugated, but near the apex it becomes nearly smooth.

A certain general resemblance which this spine bears to the spines on the dome of *Dorycrinus cornigerus* and *D. Gouldii*, especially in the structure of the base, suggests the idea that it may have formed part of the dome of a crinoid belonging to the family *Actinocrinidæ*.

OLLACRINUS SPINIGERUS, Hall.

Plate 13, figs. 4, 4a and 4b.

Trematocrinus spinigerus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 128.
Goniasteroidocrinus spinigerus, Meek & Worthen. 1866. Geol. Surv. Illinois, vol. 2, p. 222.
Goniasteroidocrinus spinigerus, S. A Miller. 1877. Cat. Am. Pal. Foss., p. 80.
Ollacrinus spinigerus, Wachsmuth & Springer. Rev. Palæocrinoidea, pt. 2, p. 219.

Near Thedford, collected by the Rev. Hector Currie in 1883: one perfect and exquisitely preserved specimen of the calyx, with the dome plates *in situ*, which he has kindly presented to the museum of the Survey.

"This beautiful specimen shews splendidly the interradial depressions described on page 218, part 2, of the Revision of the Palæocrinoidea. It also shows well the ambulacral or arm openings, and the extended arm-like water tubes, which are represented exceptionally in this species, from their base up, by two independent appendages; while in all other known species of this genus the tubes in this as in the other interradii, respectively, are suturally connected for some distance, being only divided at their outer ends." Wachsmuth.

Messrs. Meek and Worthen with some doubt and Mr. S. A. Miller positively state that this species should be placed in Lyon & Casseday's genus *Goniasteroidocrinus*, rather than in *Ollacrinus*, Cumberland. Zittel, however, in his "Handbuch der Paleontologie," as well as Wachsmuth & Springer, in the memoir cited above, take the opposite view of the case.

ANCYROCRINUS BULBOSUS, Hall.

Plate 13, fig. 5.

Ancyrocrinus bulbosus, Hall. 1862. Fifteenth Rep. N. York State Cab. Nat. Hist., p. 118, pl. 1, figs. 25 and 26.

A perfect but worn specimen of the root and part of the column of a crinoid which is clearly referable to the genus *Ancyrocrinus* and apparently to the species named above, has long been in the Museum of the Survey, labelled as having been collected in the township of Bosanquet.

It is thirty-three millimetres in height from base to summit, thirteen mm. in breadth, as measured from the apices of two lateral processes, and four across the summit. The base is shortly and broadly conical or bluntly pointed as viewed laterally, and distinctly quadrangular, with the sides faintly concave, as viewed endways. In the centre of the base there is a minute circular depression or pit, around which at a distance of about two mm. there is a circular impressed line. The four lateral ascending spinose processes upon which the genus was based, are represented by four low conical protuberances, which are slightly flattened laterally and truncated at their apices in a direction nearly parallel to the main axis of the column. At the summit of each of these truncated protuberances there is a longitudinally oval depression, in the centre of which there seems to be a minute and narrowly linear perforation. Immediately above these processes the ascending column is eight mm. broad and about seven-eighths of an inch long, and from this point it narrows gradually upwards to the summit, which, as already stated, is four mm. in diameter. Throughout its entire length the column appears to be circular, but the specimen is very much worn, and its central canal as seen from above, is distinctly four lobed.

BLASTOIDEA.

PENTREMITIDEA FILOSA. (N. Sp.?)

Plate 14, figs. 1, 1 a, 1 b.

Perhaps the same as *Pentremites Whitei*, Hall, a description of which may be found on page 150 of the Fifteenth Rep. N. York St. Cab. Nat. Hist.

Of medium size, height about one-fourth greater than the maximum breadth, which latter ranges from a little below the middle of the specimen to the base of the radial sinuses: lateral outline subovate but conical at the base and truncated at the summit: transverse section, in the thickest part, pentagonal in outline with nearly straight sides, which latter, however, are very faintly depressed in the centre, and as faintly convex laterally.

Ab-oral side inversely and doubly pyramidal, three-sided at and near the base of the body, but gradually becoming five-sided and pentalobate above; its lower portion rather narrowly conical as viewed sideways, its upper moiety broadening more rapidly upward and outward. Oral side not quite three times as high as the ab-oral, of nearly equal thickness for about one-third of its height, then narrowing gradually and convexly upwards from about the middle of the calyx to the summit: peristome narrow and concavely excavated.

Basals reaching rather more than half-way to the bases of the radial sinuses, and together forming a rather shallow cup, which is three-sided below, five-sided above and angularly five-lobed at its upper margin, and whose breadth above is nearly twice its height. Basal plates three, two pentagonal and one quadrangular.

The "bodies" or undivided portions of the radials broaden outwards more rapidly than the basals do, and from this circumstance it follows that an obtuse angle is formed at the junction of the basals with the radials, especially in a line with the ambulacra.

Radials occupying about eleven-thirteenths of the entire height of the calyx, lanceolate in outline, with a truncated base, and rather more than twice as high as broad. The apices of each of the two adjacent radials are united so as to form an acute point, which projects a little above the oro-anal surface. Radial sinuses very deeply cleft, and occupying about nine-tenths of the total height of each radial. The sides bordering the sinuses are elevated and formed into sharp edges, which stand out at right angles above the ambulacra in such a way as to form prominent radial lips, which are somewhat effuse and most raised around the bases of the ambulacra.

Ambulacra linear, rather narrow, increasing in breadth regularly but very slowly upwards, so that they are nearly twice as broad at their summits as at their bases, which latter are narrowly rounded. The food groove in the centre of each ambulacrum deepens towards the summit, and is almost obsolete at and near the base, while the outer sides of the ambulacra are depressed in such a way as to form a deep groove on each side next to the radial lips. The whole surface of each ambulacrum, although convex towards the centre, is not prominent, but on the contrary sunk a little below the general level of that of the radials.

The interradial on the anal side is comparatively large, and plainly visible in a side view, especially when examined with a lens: its outline is rhomboidal, but its apex is narrowly and rather deeply emarginate. The other interradials are extremely small, and not visible at all in a side view, as they are sunk in the oro-anal excavation, and form a narrow rim around the spiracles.

The posterior spiracle is confluent with the anal aperture. The other spiracles (four in number) are rather large, between crescentic and reniform in outline, rounded on their inner margins, and placed close to the central opening. They are situated within the interradials, and occupy nearly their whole area, leaving only a very narrow rim exposed. They are equal in size, similar in shape, and partly divided in the centre by an incomplete septum. Central opening pentagonal or obscurely five-lobed, but shallowly and concavely emarginate on the anal side.

Summit plates, hydrospires, pinnules and column unknown.

The surface ornamentation consists of exceedingly fine concentric lines, which follow the general contour of each plate. These lines are always too minute to be seen without the aid of a lens, but are much coarser and more sharply defined in some specimens than in others.

Dimensions of one of the most perfect specimens collected: Height, thirteen millimetres; maximum breadth, nine and a half mm.; height of radial, eleven; breadth of radial, five; depth of sinus of radial, nine and a half.

Near Thedford, Rev. Hector Currie, 1876-82: nine specimens, most of which are perfect, undistorted and remarkably well-preserved.

A provisional name has been given to the specimens described above, because it is almost impossible to decide whether they are or are not identical with the *Pentremites Whitei* of Hall, owing to the very peculiar state of preservation of the latter.

Professor Hall's types of *P. Whitei* (two of which he has kindly lent to the present writer, for comparison) are all stated to be "crushed" so that "their true form cannot be known." One of the specimens forwarded by Professor Hall has the pinnules preserved on all sides, so that the whole of the interradials and summit characters, as well as the upper halves of the radials, are completely hidden from view. In the other, most of the pinnules are preserved, especially on one side. This latter is the only specimen which shews any of the interradials, and in it the writer has failed to find more than one, which appears to be the interradial on the anal side. Moreover, the characters of this supposed solitary interradial on the anal side in one, and those of the lower and exposed half of the body in both of the typical examples of *P. Whitei* that the writer has been able to examine, appear to be essentially similar in all respects to those of the corresponding parts in the Canadian specimens.

But, on the other hand, Professor Hall distinctly states that the interradials of *P. Whitei* are "comparatively large and lozenge shaped," and if this is true of any of its interradials other than the one on the anal side, then *P. Whitei* must be both generically and specifically distinct from the specimens collected by the Rev. H. Currie. Again, in the original description of *P. Whitei*, the pseudambulacral fields (ambulacra) are said to "extend a little more than half the length of the body," and the pseudambulacral areas (or radial sinuses) to occupy about two-thirds the length of the radials, from which it would seem that the radials in Professor Hall's species are not nearly so deeply cleft as they are in the Canadian specimens.

By whatever name they may eventually be known, the Thedford specimens now under consideration differ from the genus *Pentremites*, as recently restricted by Etheridge & Carpenter in their "Catalogue of the Blastoidea in the British Museum," in the fact that only the interradial on the anal side is visible in a side view. In this particular, as well as in the fact that the posterior spiracles are confluent with the anus, they resemble *Troostocrinus* as defined in the monograph just cited, but their base is *not* long and tapering, and upon the whole they seem to agree best with the characters of *Pentremitidea* as expressed in the same volume.

NUCLEOCRINUS ELEGANS, Conrad.

Plate 14, fig. 2. (Summit plates only.)

Nucleocrinus elegans, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 289, pl. 15, fig. 17.
" " Hall (as of Conrad). 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 147, pl. 1, figs. 14 and 15.
Nucleocrinus lucina? Hall. Montgomery. 1881. Can. Nat. and Geol. (N. S.) vol. X., p. 80, with three woodcuts.
Nucleocrinus Canadensis, Montgomery. Ib., p. 83.
Elæacrinus lucina, Hall, var. *Canadensis*, Mongomery. Etheridge and Carpenter. 1886. Cat. Blast. Brit. Mus., p. 36, pl. 18, fig. 19.

Near Thedford, Rev. Hector Currie, 1877-82: five specimens.

These differ slightly from typical specimens from the State of New York, in being not quite so globose in their contour. Judging from diagrams forwarded by Mr. Wachsmuth there would appear to be some minor differences in the shape and number of the summit plates in examples from the two localities, but as the sutures between these plates are nearly always difficult to define, these supposed differences may be more apparent than real. In each of the Canadian specimens the summit plates are preserved, and these, as represented in the figure on plate 14, appear to be seven in number, viz., one rather large and somewhat excentric central or sub-central plate, which is partly surrounded by four large and two small proximals. In the New York specimens, the lower portion of the central or sub-central plate is divided transversely by a suture in such a manner as to separate from it an eighth and distinct anal plate, which is pentagonal in outline, and of which suture or plate no trace has yet been detected in the Canadian specimens. In other species of the genus, however, Mr. Wachsmuth states that some of the sutures of the summit plates are as frequently anchylosed as not, and it may be that this is the case with the suture in question in the few Canadian examples of *N. elegans* that have yet been collected. Further, the outer margin in each of the four large proximals in the New York specimens of *N. elegans* is represented by Professor Hall, as well as by Mr. Wachsmuth, as convex in the middle and concave only at the sides, whereas the outer margin in each of the larger proximals of the Canadian specimens is uniformly though rather shallowly concave. Still, these differences, whether real or apparent, can scarcely be regarded as of specific importance, and Professor R. P. Whitfield, who has kindly compared some of the specimens collected by the Rev. H. Currie with Conrad's type of *N. elegans* now in the American Museum of Natural History in New York city, entertains no doubt as to their identity with that species.

Some of the specimens collected by Mr. Currie are more elongated than others, and it was at one time supposed that the most elongated forms might possibly be referable to *N. lucina*, Hall, but in that species, as shown in an authentic specimen forwarded by Professor Whitfield and as stated by Prof. Hall, the sides are deeply and angularly concave whereas those of *N. elegans* are nearly flat.

GRANATOCRINUS LEDA, Hall (Sp.)

Plate 14, figs. 3, 3 a, 3 b, 3 c, 3d and 3f.

Pentremites leda, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 149, pl. 1, fig. 11.
Pentremitidea leda, Hall ? sp., Etheridge and Carpenter. 1886. Cat. Blast. in Brit. Mus., pp. 12, 17, 104, pl. 5, figs. 12, 13 and 14.

Near Thedford, Rev. Hector Currie, 1878 : three perfect and beautiful specimens, two of which are entirely free from distortion.

All three have been directly compared with two of the types of *Pentremites Leda* kindly forwarded by Professor Hall, which latter, however, are crushed nearly flat laterally and do not shew any of the spiracles. The only appreciable difference that the writer has been able to detect between the Canadian and the New York State specimens, is that in the former the whole surface of each of the interradials, all of which are visible in a side view, is distinctly but irregularly corrugated when examined with a lens, while in the latter most of the surface is covered by fine lines which follow the contour of each plate, and by only a few and less distinct corrugations which are often altogether absent. This difference, even if constant, which it does not appear to be, is probably not even of varietal importance.

The species is placed in the genus *Granatocrinus*, rather than in *Pentremitidea* as suggested by Etheridge and Carpenter, mainly on the authority of Mr. Wachsmuth, who informs the writer that it "is intermediate between *Granatocrinus* and *Pentremitidea*, but nearer the former. It has five circular spiracles, that of the posterior side confluent with the anal aperture; all five deltoid pieces are plainly seen in a side view, and the ambulacra extend to almost the full length of the calyx; the basals slightly projecting."

Professor Whitfield thinks that the *Pentremites Maia* of Hall is only a variety of the present species.

CODASTER CANADENSIS, Billings.

Plate 14, Figs. 4 and 4 a.

Codaster Canadensis, Billings, 1869. Am. Journ. Sc. and Arts, Series 2, vol. XLVIII., p. 79.
" " " 1870. Ann. Mag. Nat. Hist., Series 4, vol. V., pp. 262, 263.
" " " 1874. Geol. Surv. Can., Pal. Foss., vol. II., pp. 100, 101.
Codaster Hindei, Etheridge and Carpenter. 1882. Ann. and Mag. Nat. Hist., Series 5, vol. IX., p. 235.

The types of *C. Canadensis* appear to have been collected by Mr. Johnson Pettit in 1868 in the township of Bosanquet, and from the same township, three-quarters of a mile from Thedford, the Rev. Hector Currie has since obtained twelve other specimens, two of unusually large size, in 1882-84, three of which he has kindly forwarded to the writer for examination and study.

Although the name suggested by Mr. Billings is here provisionally retained, partly because it is the oldest and partly because it was published in one of the Survey reports, it is quite possible that it may have to be abandoned in favour of the later name given to it by Messrs. Etheridge and Carpenter, on the ground that the former was not accompanied by a recognizable definition of its specific characters.

On page 92 of a paper entitled "On the Devonian Fossils of Canada West," published in the "Canadian Journal" (of Toronto) for May, 1860, in reference to the genus *Cyrtodonta*, Mr. Billings himself writes: "I have been the first to describe correctly and illustrate this genus under a name that is in no respect inappropriate, and I have a right to retain that name against those which are objectionable *or not founded on* *an intelligible generic description.*" The clause italicized (the italics are the present writer's) if applicable to a genus ought to be equally so to a species, and if this be the case, the few remarks published about some of the minute structural peculiarities of *C. Canadenis* can scarcely be regarded as an intelligible specific description.

But, in spite of Mr. Billings' contention, the majority of American palæontologists seem to have rejected his genus *Cyrtodonta* and to have adopted the earlier name *Cypricardites*, Conrad, notwithstanding the extremely vague and unsatisfactory definition of the characters of the latter, and every naturalist knows that many of the species proposed by such writers as Linnæus and Lamarck in Europe, and Rafinesque and Conrad in America, are universally accepted to-day although no one pretends that they could be identified from the original description. It is also only proper to add that although the shales of the Hamilton Group of Ontario have been diligently examined by many collectors for the last twenty years, it has yet to be shewn that they have yielded more than one species of *Codaster*, and further, that the types of *C. Canadensis* have for many years been preserved in the Museum of the Survey which is and always has been freely accessible to all.

ELEUTHEROCRINUS CASSEDAYI, Shumard and Yandell.

Plate 14, figs. 5, 5a and 5b.

Eleutherocrinus Cassedayi, Shumard and Yandell. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 73, plate 2.

Near Thedford, Rev. J. M. Goodwillie, 1882: two good and exceptionally well preserved specimens, one of which (the original of the figures on Plate 14) he has generously presented to the Museum of the Survey.

In reference to this latter, which he has minutely examined, Mr. Wachsmuth writes: "Your specimen is most beautifully preserved, especially the ambulacra which are excellently shewn, the food grooves can be followed up to the sockets of the pinnules. I think the anus has never been described in this genus, it having been taken for a mere break in the plate. Your specimen shows that it is located at the right upper edge of the azygos radial, which is somewhat excavated and constitutes the outer wall of the triangular aperture."

MOLLUSCOIDEA.

BRACHIOPODA.

LINGULA LIGEA, Hall.

Lingula ligea, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 76.
" " " 1867. Pal. St. N. York, vol. IV., part 1, p. 7, pl. 1, figs. 2a, and 2b.

Near Thedford, Rev. Hector Currie, 1882: one specimen.

LINGULA THEDFORDENSIS. (N. Sp.)

Plate 15, fig. 1.

Shell strongly compressed, thickest in the umbonal region: lateral outline rather broadly subelliptical; length about one-third greater than the maximum breadth. Lateral margins nearly straight and but slightly convex in their central portions, but narrowing gently in a convex curve at and towards each extremity; anterior margin regularly rounded; cardinal slopes slightly convex, diverging forward and outward from the beaks at an angle of about one hundred and twelve degrees, and not at all angular or even subangular at their junction with the lateral margins; beaks small and not very prominent.

Surface polished and glossy, but marked with fine, concentric, raised lines of growth, which are crossed by numerous, closely arranged and almost equally minute radiating raised lines, which extend from the beaks to the anterior margin and are most prominent on and near the latter.

Dimensions of the specimen figured: maximum length, fifteen millimetres and a half; greatest breadth, eleven mm.; maximum thickness, two and a half. In another specimen the dimensions are: length, twenty-one mm.; breadth (approximately) fourteen and a half; thickness, three.

Near Thedford, Rev. Hector Currie, 1882: two specimens, the smaller and more perfect of which is figured. In the other the beak is somewhat more prominent and pointed.

This species seems to be somewhat nearly related to the *Lingula maida* of Hall, *but differs therefrom in its broader and more regularly elliptical outline, as viewed laterally, as well as in the greater convexity of its cardinal slopes, which diverge at a much more obtuse angle. It approaches also in shape to the oval variety of *L. punctata* represented by figure 6 f of plate 1 of the first part of the fourth volume of the "Palæontology of the State of New York," but is broader in proportion to its length and its surface is not punctate.

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*Pal. State New York, vol. IV., pt. 1, p. 9, pl, 2, fig. 13.

PRODUCTELLA (STROPHALOSIA?) TRUNCATA, Hall.

Plate 16, figs. 1 and 2.

Productus truncatus, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 171.
Strophomena pustulosa, Hall. 1843. Geol. Rep. 4th Distr. N. York, p. 189, fig. 4, "but not *Productus pustulosus*, Phillips.
Productella truncata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 160, pl. 23, figs. 12-24.
Productus (*Productella*) *truncatus*, (Hall) Walcott. 1884. Pal. Eureka Dist., p. 131, pl. 14, fig. 2.

Bartlett's Mills, near Arkona, and near Thedford in the township of Bosanquet, Revs. Hector Currie and J. M. Goodwillie, 1882: a few specimens which are referred to this species solely on the authority of Prof. R. P. Whitfield.

As compared with Professor Hall's description and figures of *P. truncata*, however, these specimens seem to differ materially in their far less convex ventral valves, (which resemble *Leptæna* or *Chonetes* in this respect rather than *Productus* or *Productella*, whose umbones are not at all prominent, and neither broadly nor distinctly troncated. It is difficult to see how the specimens from Arkona and Thedford are to be distinguished from some forms of the *Strophalosia productoides* of Murchison, especially from such as are represented on plate 19, figures 15, 16 and 19 of Dr. Davidson's monograph of the British Devonian Brachiopoda.

In 1882 several good examples of *S. productoides* were collected by Dr. R. Bell from rocks apparently of about the age of the Hamilton Formation on the Athabasca River in the first ten miles below the Clearwater, the most perfect of which is represented, for comparison, on Plate XV. This beautiful fossil was compared by Dr. Davidson with authentic English and European examples of *S. productoides* and pronounced somewhat confidently to be identical therewith (as the writer had previously supposed was the case) in the spring of 1883. In the specimens from Arkona and Thedford the umbones are not so prominent and the so-called pseudo-deltidium not so distinctly marked as in those from the Athabasca, but these apparent differences seem largely attributable to the much greater size of the latter and Davidson's figures show that specimens from various localities in England vary quite as much in both of these characters.

It is true that in two of the specimens from Arkona, though apparently not in all, the beak of the ventral valve is very faintly truncated, but DeVerneuil represents the beak of the corresponding valve of the shell which he calls *Productus membranaceus* and which Davidson places in the synonymy of *S. productoides*, as distinctly truncated. Prof. Hall states that "on the authority of M. de Verneuil, the *Strophomena pustulosa* has been referred to the *Productus* (*Strophalosia*) *Murchisonianus* of De Konick," or, in other words, that De Verneuil thinks *P. truncata*, Hall, is synonymous with the shell which Davidson calls *S. productoides*, and to the writer it seems that de Verneuil's figures of *Productus membranaceus* would do very well for *P. truncata*. On the other hand, Mr. C. D. Walcott considers that the two shells, i. e., *P. truncata* and *S. productoides*, "present but very few characters in common."

CHONETES CARINATA, Conrad.

Strophomena carinata, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 257.
" *syrtalis*, Conrad. " Ib., p. 254, pl. 14. fig. 1.
Chonetes coronata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 133, pl. 21, figs. 9–12, incl.
Chonetes carinata, S. A. Miller (as of Conrad). 1877. Am. Pal. Foss., p. 108.
Chonetes coronata, Whitfield. 1882. Geol. Wiscons., vol. IV., p. 327, pl. 25, fig. 16.

Bartlett's Mills, near Arkona, Rev. J. M. Goodwillie, 1882: one perfect and well preserved specimen showing the exterior of both valves.

Professors James Hall and R. P. Whitfield both think that the specific name of this shell should be written *coronata* rather than *carinata*. The former doubtless would be the more appropriate of the two.

STREPTORHYNCHUS PERVERSUM, Hall.

Orthis perversa, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 97.
Orthisina alternata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist.
Streptorhynchus perversa. Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 72, pl. 9, figs. 13–17 and fig. 26.

Lot 24, Concession 3, Township of Bosanquet, J. Richardson, 1859: one small but perfect specimen which was identified with this species or variety many years ago by Mr. E. Billings.

Professor Hall regards *S. perversum* as only a varietal form of *S. Chemungense*, Conrad.

STROPHODONTA PLICATA, Hall.

Strophodonta plicata, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 90.
" " " 1867. Pal. State N. York, vol. IV., pt. 1, p. 144, pl. 63, figs. 30-32.

Near Thedford, Rev. J. M. Goodwillie, 1882: one rather small but very characteristic specimen.

SPIRIFERA SUBDECUSSATA. (N. Sp.)

Pl. 15, figs. 3 and 3 a.

Shell somewhat compressed, the maximum thickness through the closed valves being a little less than one-half the greatest length of the ventral valve: lateral outline transversely rhomboidal or obscurely pentagonal, but with the front margin nearly semicircular: breadth a little greater than the length: greatest breadth at the hinge line, whose extremities are angular.

Ventral valve considerably elevated at the umbo: cardinal margins diverging at an angle of about 132°: mesial sinus broad and shallow, especially at and near the anterior margin: area large, ascending and obliquely flattened, rather more than one-fourth as high as broad and transversely striated, pseudo-deltidium also large, its breadth at the base nearly equalling its height.

Dorsal valve very moderately convex, with a broad, low, rounded mesial fold, which is most strongly defined on and at the anterior margin.

Surface ornamented by about fifteen low, rounded ribs on each side of the mesial fold and sinus. The central portion of each valve is quite devoid of ribs, but the whole surface is faintly and concentrically striated, and the ribs on the lateral areas are marked with exceedingly minute and closely arranged radiating lines.

Dimensions of the only specimen collected: maximum length, thirty-eight millimetres; greatest breadth, forty-five mm.; approximate thickness through the closed valves, eighteen; height of hinge area in the ventral valve, twelve; breadth of pseudo-deltidium of the same, at its base, eleven.

Banks of the Thames River, Moraviantown, Rev. J. M. Goodwillie, 1882: one imperfect and not very well preserved specimen.

The shape and coarser markings of this shell are extremely like those of the *S. aspera* of Hall,* from "calcareous shales of the age of the Hamilton Group" in Iowa and Illinois. In Professor Hall's species, however, the entire surface of the valves is represented as granulose, whereas in the *S. subdecussata*, in addition to the concentric lines of growth which are common to all brachiopodous shells, the ribs on the lateral areas are marked by exceedingly fine and crowded radiating lines, which are scarcely visible to the naked eye, and no traces of granulations can be detected, or have yet been detected, on any portion of its surface.

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* Geol. Iowa, vol. I., part 2, (1858) p. 508, pl. 4, figs. 7 a, b, c, d.

NUCLEOSPIRA CONCINNA, Hall.

Atrypa concinna, Hall. 1843. Geol. Rep. Fourth Distr. N. York, p. 200, fig. 3.
Nucleospira concinna, Hall. 1859. Twelfth Rep. N. York St. Cab. Nat. Hist., pp. 25 and 26.
" " " 1857. Pal. State N. York, vol. IV., pt. 1, 279, pl. 45, figs. 33-57.

Near Thedford, Rev. J. M. Goodwillie, 1882: nine good specimens.

MERISTELLA UNISULCATA, Conrad.

Atrypa unisulcata, Conrad. 1841. Ann. Rep. Pal. N. York, p. 56.
Rhynchonella unisulcata, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 125.
Athyris (?) *unisulcata*, Billings (as of Conrad). 1860. Canadian Journal, pl. 32, figs. 39–42.
Meristella unisulcata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 309, pl. 50, figs. 18, 35.

Township of Bosanquet, Mr. J. Pettit, 1868: two ventral valves; and near Thedford, Rev. J. M. Goodwillie, 1882: one specimen with both valves preserved. The species has previously been recorded from the Corniferous Limestone of Ontario, but the specimens indicated above are the only ones that the writer has seen from the Hamilton Group of that province.

MERISTELLA HASKINSI, Hall.

Meristella Haskinsi, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 84.
" " " 1867. Pal. State N. York, vol. VI., pt. 1, p. 306, pl. 49, figs. 23, 35.

Near Thedford, Rev. J. M. Goodwillie, 1882: one specimen which is nearly perfect, but which has most of the outer and part of the inner layer of the test exfoliated.

RETIZA (TREMATOSPIRA) NOBILIS, Hall.

Rhynchospira nobilis, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist. p. 83.
Trematospira ? nobilis, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 412, pl. 63, figs. 33-36.

Near Thedford, J. Richardson, 1859, and Rev. H. Currie, 1882: apparently not uncommon. The specimens from this locality, though nearly always much distorted, are often perfect and well preserved.

In his " Handbuch der Palæontologie," (vol. I., p .686) Zittel admits both *Rhynchospira* and *Trematospira* of Hall as sub-genera of *Retzia*, King, though Billings, in 1870, maintained that they are merely synonyms of that genus.

MOLLUSCA.

LAMELLIBRANCHIATA.

PTERINEA FLABELLUM, Conrad.

Avicula flabella, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 238, pl. 12, fig. 8.
Pterinea flabellum, Conrad. S. A. Miller. 1877. Am. Pal. Foss., p. 201.
" " " Hall. 1883. Pal. State N. York, vol. V., pt. 1. (advance copies) pl. 14 and pl. 15, fig. 1.

Township of Bosanquet, Mr. J. Pettit, 1868: five well preserved specimens.

GRAMMYSIA ARCUATA ? Conrad, Var.

Grammysia (*Leptodomus ?*) *arcuata*, Hall (as of Conrad). 1883. Pal. State N. York, vol. V., pt. 1 (advance copies), p. 15, pl. 61, figs. 1-9.

Township of Bosanquet, Mr. J. Pettit, 1868: an imperfect cast of the interior of the right valve of a shell which may represent a local variety of this species. An equally imperfect cast of a smaller but in other respects similar specimen, was collected by the Rev. Hector Currie near Thedford, in 1882.

GASTEROPODA.

TURBO SHUMARDI, De Verneuil.

Plate 16, fig. 3.

Turbo Shumardi, De Verneuil. 1846. Bull. de la Soc. Géol. de France.
" " " " Hall. 1879. Pal. State N. York, vol. V., pt. 2, p. 135, pl. 29, figs. 1-4.

Township of Bosanquet, Mr. J. Pettit, 1868: one large and characteristic cast and a smaller one, both of which show, more or less distinctly, either the blunt angulation of the periphery of the body whorl or the distant nodes on the shoulder above it.

The reference of this shell to the Linnæan genus *Turbo* does not seem to the writer to be entirely satisfactory, and it is not easy to define in what particular it differs from *Platyostoma*.

PLATYCERAS CARINATUM, Hall.

Platyceras carinatum, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 33.
" " " 1876. Illustr. Dev. Foss., pl. 2, figs. 12–29 and (1879) Pal. State N. York, vol. V., pt. 2, p. 5, pl. 2, figs. 12–29.

Township of Bosanquet, Mr. J. Pettit, 1885: five specimens.

PLATYCERAS QUINQUESINUATUM, Ulrich.

Plate 15, figs. 5 and 6, and plate 16, fig. 5.

Platyceras quinquesinuatum, Ulrich. 1886. Contr. to Americ. Palæont., Cincinnati, vol. I., p. 29, pl. 3, figs. 4, 4a, and 4b.

Near Thedford, Rev. J. M. Goodwillie, 1882: three fine specimens.

This species, which is very nearly related to some forms of the *P. symmetricum* of Hall from the Hamilton Formation of the State of New York, was described from specimens collected from the "Middle Devonian" of the Falls of the Ohio.

PLATYCERAS (ORTHONYCHIA) CONICUM, Hall.

Plate 16, fig. 4.

Platyceras conicum, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 31.
Platyceras (*Orthonychia*) *conicum*, Hall. 1876. Illustr. Dev. Foss., pl. 1, figs. 13–23, and pl. 2, figs. 30 and 31. Also, Pal. State N. York, vol. V., pt. 2, (1879) p. 3, pl. 1, figs. 13–23, and pl. 2, figs. 30 and 31.

One fine specimen of this species was collected in the township of Bosanquet by Mr. J. Pettit in 1868, another near Thedford in the same township by the Rev. Hector Currie, and a third, also near Thedford, by the Rev. J. M. Goodwillie, in 1882, all of which are now in the Museum of the Survey. The species was first recorded as occurring near Widder by Professor Hall in 1876.

PLATYOSTOMA LINEATUM, Conrad.

Platyostoma lineatum, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., pt. 2, p. 276, pl. 17, fig. 7.
" " Hall. 1876. Illustr. Dev. Foss., pl. 9, figs. 1-21, and Pal. State N. York, (1879) vol. V., pt. 2, p. 21, pl. 10, figs. 1-21.

Township of Bosanquet, Mr. J. Pettit, 1868, and near Thedford, Rev. J. M. Goodwillie, 1882: several well preserved and nearly perfect specimens. The species is not uncommon in the Corniferous Limestone of Ontario.

In his Catalogue of "American Palæozoic Fossils," Mr. S. A. Miller has changed the name of Conrad's genus *Platyostoma* to *Platystoma*, but Zittel, in his "Handbuch der Palæontologie," retains both names on the ground that the latter had previously been proposed by Hornes for a totally distinct genus or rather subgenus of gasteropoda, from the Triassic rocks of Europe.

PLATYOSTOMA PLICATUM. (N. Sp.)

Plate 16, fig. 6.

Shell turbinate, about as broad as high, whorls certainly three (and perhaps four when perfect, the nuclear portion being broken off in the only specimen collected) increasing rapidly in size, the later ones ventricose, flattened above and step-shaped but with a rounded shoulder; suture distinct and nearly rectangular; spire moderately elevated but much shorter than the height of the aperture; body whorl strongly inflated, its base apparently imperforate or nearly so; aperture subcircular.

The only part of the test that happens to be preserved is a rather large piece of the upper part of the body whorl immediately at and behind the outer lip. In this region there are indications of faint spiral grooves with low rounded spiral ridges between them, and these are crossed by prominent, distant and very distinct transverse plications.

Maximum height of the only specimen collected, allowing for the nucleus, two inches and a quarter; maximum breadth, also two inches and a quarter; height of spire, near the aperture, not quite one inch.

Township of Bosanquet, Mr. J. Pettit, 1868: a nearly perfect cast of the interior of the shell, with a portion of the test preserved near the aperture.

In general shape this shell is extremely similar to some specimens of the *Platyostoma affine* of Billings (Geol. Surv. Can., Pal. Foss., vol.

II., p. 60, pl. 5, fig. 2), and more especially to the original of the woodcut (fig. 30) on page 60 of that volume. *P. affine*, however, is stated to have been collected from rocks which are "nearly of the age of the Oriskany Sandstone," and its sculpture is said to consist of "fine transverse striæ.........with a few obscure undulations."

CRUSTACEA.

TRILOBITÆ.

DALMANITES HELENA, Hall.

Dalmania Helena, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 89.
Dalmanites Helena, Hall. 1876. Illustr. Dev. Foss., pl. 13, figs. 11 and 12.

Township of Plympton, A. Murray, 1848: two fine specimens of the pygidium. It is somewhat doubtful, however, from what formation and locality these specimens were really collected. The printed label on the tablet upon which they were placed by Mr. E. Billings many years ago, states that they were collected by Mr. Murray from the Hamilton Formation of the Township of Plympton, but to one of them is affixed a label in Mr. Billings hand writing, marked "Nanticoke, Walpole," so that one of them, if not both, may have come from the Corniferous Limestone. Professor Hall's specimens of *D. Helena* are said to have been obtained from the Upper Helderberg Group (the equivalent of the Corniferous Limestone) of the State of Ohio and New York.

FISHES.

MACROPETALICHTHYS SULLIVANTI, Newberry.

Agassichthys Sullivanti, Newberry. 1857. Bull. Nat. Inst., p. 3.
Macropetalichthys Sullivanti, Newberry. 1862. Am. Journ. Sc. and Arts, Series 2, vol. XXIV., p. 75.
" " " 1873. Rep. Geol. Surv. Ohio, Vol. I., pt. 2, p. 294, pl. 24, and pl. 25, figs. 1 and 1a.

Numerous fragments of the cranial plates of this species, ornamented on their exterior by the characteristic stellate tubercles, were collected by the Rev. Hector Currie near Thedford in 1882, and by the Rev. J. M. Goodwillie in the same year on the banks of the Sable River near Bartlett's Mills. Similar fragments are not infrequent in the Corniferous Limestone of Western Ontario, and a few were found by Dr. R. Bell in 1875, on the Mattagami, a branch of the Moose River, in the Hudson's Bay Territory, in rocks apparently of similar age.

LIST OF FOSSILS FROM THE HAMILTON FORMATION OF ONTARIO.

In this list the crinoids are arranged in conformity with Wachsmuth and Springer's "Revision of the Palæocrinoidea," and the blastoids with Etheridge and Carpenter's "Catalogue of the Blastoidea in the Geological Department of the British Museum," but in all the other groups the classification adopted by Zittel in his "Handbuch der Palæontologie" (Munich and Leipsig, 1876-85) has been followed.

CŒLENTERATA.

SPONGIÆ.

Receptaculites Neptuni, Defrance. . . . "Near Widder, Ont.," Hinde.

ANTHOZOA.

ALCYONARIA.

Aulopora Canadensis, Nicholson.
" cornuta, Billings.*
" filiformis, Billings.
Syringopora intermedia, Nicholson.
" nobilis, Billings. . . "Hamilton Group of Canada," Rominger.

ZOANTHARIA.

(A. *Tetracoralla*, Hæckel: = *Rugosa*, Edwards and Haime.)

Microcyclus discus, Meek and Worthen.
Zaphrentis cornicula, Lesueur. . . . . "Arkona," Nicholson.
Heterophrentis prolifica, Billings.
Cyathophyllum Zenkeri, Billings. . . . . . . "Arkona," Nicholson.
Heliophyllum exiguum, Billings.†
" Halli, Edwards and Haime.
" tenuiseptatum, Billings.

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* Dr. Rominger thinks this the young of *Romingeria umbellifera*, which is the *Aulopora umbellifera* of Billings.

† Dr. Rominger places this species in the genus *Zaphrentis*, but in the types the septa are certainly marked on their flat sides with numerous "obscure arched striæ" as Billings asserts.

Crepidophyllum Archiaci. (=Diphyphyllum Archiaci, Billings.)
" subcœspitosum. (=Diphyphyllum subcæpitosum, Nichl.)
Eridophyllum strictum, Edwards and Haime.
Acervularia profunda, Hall.
Cystiphyllum Americanum, Edwards and Haime.
" conifolle, Hall. . . . "Township of Bosanquet," Hall.
" superbum, Nicholson.
" vesiculosum, Goldfuss.

(B. *Hexacoralla*, Hæckel :=*Tabulata*, Edwards and Haime.)

Favosites Canadensis. (=Fistulipora Canadensis, Billings.)
" clausa, Rominger. . . . . "Arkona," Nicholson.
" Gothlandica, Lamarck, and var. Billingsi, Rominger.
" hemisphærica, Yandell and Shumard.
" placenta, Rominger.*
" tuberosa, Rominger. . . . . "Arkona," Nicholson.
" turbinata, Billings.
Alveolites Goldfussi, Billings.
" Rœmeri, Billings.
Striatopora Linnæana, Billings.
Pachypora cervicornis, de Blainville.
" Fischeri. (=Alveolites Fischeri, Billings.)
" frondosa, Nicholson.†
" polymorpha, Goldfuss.
Trachypora elegantula, Billings.
" ornata. (=Dendropora ornata, Rominger, teste Nicholson.)

HYDROMEDUSÆ.

HYDROIDA.

Stromatoporella granulata, Nicholson.
" nulliporoides, Nicholson.

ECHINODERMATA.

CRINOIDEA.

Taxocrinus lobatus, Hall.
Homocrinus crassus, Whiteaves.

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* According to Nicholson this is a variety of *Favosites Canadensis*, the *Fistulipora Canadensis* of Billings.

† Nicholson regards *Cladopora Canadensis*, Rominger, as synonymous with this species.

Arthroacantha punctobrachiata, Williams.
Dolatocrinus liratus, Hall.
“ lamellosus, Hall.
“ Canadensis, Whiteaves.
Megistocrinus rugosus, Lyon and Casseday.
Ollacrinus spinigerus, Hall.
Ancyrocrinus bulbosus, Hall.

BLASTOIDEA.

Pentremitidea filosa, Whiteaves.
Nucleocrinus elegans, Conrad.
Granatocrinus Leda.(=Pentremites leda, Hall.)
Codaster Canadensis, Billings.
Eleutherocrinus Cassedayi, Shumard and Yandell.

VERMES.

Spirorbis angulatus, Hall.
“ Arkonensis, Nicholson.
“ omphalodes, Goldfuss.
“ spinuliferus, Nicholson.
Ortonia intermedia, Nicholson.
Eunicites alveolatus, Hinde.
“ nanus, Hinde.
“ palmatus, Hinde.
“ tumidus, Hinde.
Ænonites compactus, Hinde. . . “Rivière au Sable,” Hinde.
Arabellites politus, Hinde.
“ similis, var. arcuatus, Hinde.
Nereidavus solitarius, Hinde.

MOLLUSCOIDEA.

POLYZOA.

Ceramopora Huronensis, Nicholson.
Botryllopora socialis, Nicholson.
Fenestella Davidsoni, Nicholson.
“ filiformis, Nicholson.
“ tenuiceps, Nicholson.

Polypora tuberculata, Nicholson.
Phyllopora prisca. (=Retepora prisca, Goldfuss, teste Nicholson.)
Ptilodictya cosciniformis, Nicholson.
“ Meeki, Nicholson.
Tæniopora exigua, Nicholson.
“ penniformis, Nicholson.
Ceriopora Hamiltonensis, Nicholson.
“ Huronensis, Nicholson.
Fistulipora incrassata, Nicholson.
“ minutissima. (=Callopora minutissima, Nicholson.)
“ utriculus, Rominger. . . . . . . “Widder, C. W,” Rominger.
Monotrypa quadrangularis, Nicholson.
Amplexopora Barrandei, Nicholson.
“ moniliformis, Nicholson.
Ascodictyon fusiforme, Nich. and Eth., jun. . . . “Widder,” Nicholson.
“ stellatum, Nich. and Eth., jun. . . . “ “

BRACHIOPODA.

Lingula ligea, Hall.
“ Thedfordensis, Whiteaves.
Discina Doria, Hall.
Crania crenistriata, Hall.
“ Hamiltoniæ, Hall.
Productella (Strophalosia ?) truncata, Hall.
Chonetes carinata (or coronata) Conrad.
“ lepida, Hall.
“ scitula, Hall.
Orthis Vanuxemi, Hall.
Streptorhynchus perversum, Hall.
Strophodonta ampla, Hall.
“ concava, Hali.
“ demissa, Conrad.
“ inæquistriata, Conrad.
“ nacrea, Hall. (=S. lepida, Hall.)
“ perplana, Conrad.
“ plicata, Hall.
Strophomena (Leptagonia) rhomboidalis, Wilckins.
Spirifera granulifera, Hall.
“ mucronata, Conrad.
“ Parryana, Hall.
“ sculptilis, Hall.
“ subdecussata, Whiteaves.

Spirifera (Ambocœlia) umbonata, Conrad.
Spirifera (Martinia) fimbriata, Conrad.
" " Maia. (=Athyris Maia, Billings.)
Cyrtina Hamiltonensis, Hall.
Spirigera spiriferoides, Eaton.
Meristella nasuta. (=Atrypa nasuta, Conrad, and Athyris Clara, Billings.)
" Haskinsii, Hall.
" unisulcata, Conrad.
" scitula, Hall.
" rostrata, Hall.
Retzia Chloe. (=Athyris Chloe, Billings.)
Retzia (Trematospira) nobilis, Hall.
Atrypa reticularis, Linnæus.
Rhynchonella Tethys, Billings.
Rhynchonella (Leiorhynchus) Laura, Billings. (=L. multicosta, Hall.)
Rhynchonella (Leiorhynchus) Huronensis, Nicholson.
Rhynchonella (Stenoschisma) Billingsi, Hall. (=R. Thalia, Billings.)

MOLLUSCA.

LAMELLIBRANCHIATA.

Pterinea flabellum, Conrad.
Grammysia arcuata? Conrad, var.

GASTEROPODA.

Turbo Shumardi, de Verneuil.
Platyceras carinatum, Hall.
" dumosum, Conrad and var. rarispinum, Hall.
" erectum? Hall.
" quinquesinuatum, Ulrich.
" (Orthonychia) conicum, Hall.
Platyostoma lineatum, Conrad.
" plicatum, Whiteaves.

PTEROPODA.

Tentaculites attenuatus, Hall.

CEPHALOPODA.

Orthoceras Anax, Billings.
" exile, Hall.
Goniatites uniangularis, Conrad.

ARTHROPODA.

CRUSTACEA.

OSTRACODA.

Cythere? (Beyrichia) punctulifera, Hall.

TRILOBITA.

Phacops rana, Green.
Dalmanites Boothii, Green.
" Helena, Hall.

FISHES.

Macropetalichthys Sullivanti, Newberry.

(Accidently omitted from the list of Hydroida.)

Stylodictyon retiforme, Nicholson and Murie. Riviére-aux-Sables, Hinde.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

3. *On some Fossils from the Triassic Rocks of British Columbia.*

In 1875, numerous well-preserved specimens of a fossil shell which was identified by the writer with the *Monotis subcircularis* of Gabb, a characteristic species of the Upper Trias of California, were collected by Dr. Selwyn on the Peace River, in latitude 56° 10′ and longitude 122° 10′.

In 1877, specimens of the same species were obtained by Mr. J. Hunter on the Upper Pine River, in latitude 55° 30′ and longitude 122°; while an obscure fossil, which was doubtfully referred also to *Monotis subcircularis*, was collected by Dr. G. M. Dawson on the Whipsaw Creek, at the head-waters of the Similkameen River. During the same year, limestones supposed to be of Triassic origin, on account of the occurrence in them of a *Terebratula* like *T. Humboldtensis*, Gabb, and of a few scattered joints of a species of *Pentacrinites* similar to those of the Nevada Trias which Professors Hall and Whitfield doubtfully referred to the *P. asteriscus* of Meek, were observed by Dr. Dawson at McDonald's River on Nicola Lake. These limestones form part of a group of rocks mostly of volcanic origin, for which the name of the "Nicola Series" was suggested.

In 1878, rocks holding fossils which are believed to be Triassic, were discovered by Dr. Dawson at several localities in the central and southern portions of the Queen Charlotte Islands, viz., at Crescent Inlet on Moresby Island, on the south shores of Skidegate and Houston Stewart Channels, on the north coast of Kun-ga Island, and at Section Cove at the north end of Burnaby Island; also on the north-west coast of Vancouver Island, at Browning Creek in Forward Inlet, Quatsino Sound, and in Forward Inlet near Observatory Rock. In the same year Mr. J. W. McKay gave to Dr. Dawson some pieces of shale from Glenora on the Stikine River, which hold imperfect valves of a species of *Halobia*. These specimens are of interest as coming from the most northerly locality in the province, and indeed on the continent of North America, from which Triassic fossils have yet been obtained.

While engaged in a special geological exploration of the northern part of Vancouver Island and adjacent coasts, in 1885, fossils apparently of Triassic age were collected by Dr. Dawson at Robson Island, and on the east side of Winter Harbour in Forward Inlet, at Alexander Harbour on Galiano Island, in a bay five miles and a half west of Cape Commerell, and on Hernando Island in the Strait of Georgia. Finally, a series of fossils, which are probably also of Triassic age and which are remarkably well-preserved, was obtained by Mr. R. G. McConnell, in 1887, on the Liard River, about twenty-five and thirty miles below Devil's Portage, or, approximately in latitude 59° 16′, and longitude 125° 35′.

The stratigraphical relations of the rocks from which the fossils here reported on were obtained, will be found described in the Reports of the Survey for each of the years in which the fossils were collected.

All the specimens collected at these localities are in the Museum of the Survey, and the collection of the Triassic fossils of British Columbia now contained therein consists of three species of brachiopoda, five of lamellibranchiata, one of gasteropoda and eight of cephalopoda, besides the undeterminable fragments of *Pentacrinites* already referred to. Of these, only four (viz., *Terebratula Humboldtensis*, *Monotis subcircularis*, *Halobia Lommeli* and *Arcestes Gabbi*,) can be identified with previously described species, the rest being apparently new to science.

The present paper will consist of a systematic list of the whole of the species at present in the Museum of the Survey from the formation and province indicated in its title, with descriptions and figures of those that are believed to be new. For critical and valuable suggestions in regard to some of the latter, and for the description of a supposed new genus of cephalopoda, the writer is indebted to Professor Alpheus Hyatt.

BRACHIOPODA.

SPIRIFERINA BOREALIS. (N. Sp.)

Plate 17, fig. 1.

Shell transversely subelliptical, broadly rounded in front and obtusely subangular in the middle behind, a little broader than long, and broadest at the midlength: cardinal angles rounded: surface of the valves marked with angular and rather coarse radiating plications.

Ventral valve moderately convex, most prominent on each of the outer boundaries of the angular and well-defined mesial sinus, which is narrow on and near the beaks but which widens rapidly towards the front margin, its maximum width being not much less than one-half the greatest breadth of the whole valve. Umbo broad, curved and slightly depressed, but projecting considerably above the general level of the hinge line: beak incurved and slightly decurved: area concavely arcuate, broadly triangular in outline and nearly three times as broad as high: pseudo-deltidium rather narrowly triangular and apparently a little higher than broad. Surface marked with five well-defined, angular, radiating plications on each side of the mesial sinus and with one in the sinus.

Dorsal valve also moderately convex, its mesial fold elevated and somewhat narrower than, but in other respects corresponding to, the sinus in the opposite valve. Umbo narrower and very much less elevated than that of the ventral valve, its beak lightly incurved. Surface marked with two well-defined and angular radiating plications on the mesial fold, and with four similar ones on each side. In addition to the radiating folds, the surface of each valve is marked with numerous and for the most part rather closely disposed lines of growth.

Characters of the interior of the valves unknown.

Dimensions of the only specimen collected: maximum length, twenty-nine millimetres; greatest breadth, thirty-three mm. and a half; maximum thickness through the closed valves, twenty-one mm.; greatest breadth of the mesial sinus of the ventral valve, fourteen mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, August, 1887: one perfect but somewhat distorted and abnormally developed specimen.

On the right-hand side the two radiating plications next to the outer boundary of the mesial sinus in the ventral valve and the one next to the fold in the dorsal, bifurcate distinctly at about their midlength, whereas on the left-hand side all the plications are clearly simple and undivided throughout their entire length.

TEREBRATULA HUMBOLDTENSIS, Gabb.

Terebratula Humboldtensis, Gabb. 1864. Geol. Surv. Cal., Palæont., vol. I., p. 34, pl, 6, figs. 35 and 35 a, b.
" " Hall and Whitfield (as of Gabb). 1877. U.S. Geol. Expl. Fortieth Parallel, vol. IV., p. 282, pl. 6, figs. 22-24.

McDonald's River, on Nicola Lake, Dr. G. M. Dawson, 1887, as already recorded on page 171 B of the "Report of Progress of the Geological Survey of Canada for 1877-78."

TEREBRATULA LIARDENSIS. (N. Sp.)

Plate 17, figs. 2, 2 a, 2 b and 2 c.

Shell rather below the medium size, varying in outline from somewhat narrowly ovate to almost circular, but always a little longer than broad, moderately convex, the thickness through the closed valves varying from a little less to slightly more than one-half the maximum length, the broad specimens being proportionately flatter than the narrow ones.

Ventral valve longer and more convex than the dorsal, its umbo somewhat elevated but obtuse and distinctly recurved at its apex, which latter is obliquely truncated in such a way that the produced inner margin of the foramen overhangs and partially overlaps the small and sunken deltidium. Foramen complete but apparently lightly channelled and rather spout-like in front, nearly circular in outline but a little longer than wide. Front margin with two low, narrow, rounded folds, which are separated by a shallow and equally narrow mesial sinus, and which gradually become obsolete and disappear before reaching the midlength. On the outer side of each of these folds there is a correspondingly shallow but somewhat broader depression.

Dorsal valve very gently convex, its umbonal region obliquely depressed and its beak small and scarcely projecting above the highest level of the hinge margin. Front margin with one central fold and two lateral folds, which are low, rounded and separated by two shallow depressions which do not extend quite as far back as those on the ventral valve do. When examined with a lens, a faintly impressed line, which probably indicates the existence of a raised mesial septum within, may be seen to extend longitudinally from the umbo nearly half way to the front margin, along the centre of the exterior of the valve.

Surface nearly smooth and marked only with a few rather distant lines of growth. Characters of the interior of the valve unknown.

Dimensions of one of the largest specimens of the narrow variety: maximum length, nineteen millimetres; greatest breadth, fourteen mm.; maximum thickness, ten mm. In the largest specimen collected of the broad variety, the corresponding measurements are: length, nineteen millimetres; breadth, seventeen mm.; thickness, nine mm.

Liard River, about twenty-five miles below Devil's Portage, also about thirty miles below the same portage, R. G. McConnell, 1887. At the locality first mentioned, a small piece of limestone was obtained, containing five specimens of this species *in situ;* while at the second seven well-preserved casts of the interior of both valves, with a little of the inner layer of the test remaining, were collected. Three of the latter are evidently casts of adult shells in which the double fold on the front margin is fully developed, while the remaining four are as obviously immature.

This species seems to differ from *T. Humboldtensis* in its distinctly biplicated front margin, which is not at all truncated. Accurate drawings of two of the best specimens collected by Mr. McConnell have been kindly compared by Dr. C. A. White with Professors Hall and Whitfield's types of *T. Humboldtensis* and with Gabb's figures of his type specimens. The double fold at the front in the present species is regarded by Dr. White as a probably good distinguishing character, and he thinks that the drawings sent indicate a proportionately shorter and more robust shell than *T. Humboldtensis.* He adds, also, that the specimens of Hall and Whitfield and the figures of Gabb show that in *T. Humboldtensis* "there is a very shallow median sulcus, or a mere median flattening of the dorsal valve at the front, with which that part of the ventral valve coincides. This gives the seeming truncation of the front to which they refer."

The indications of a rather long mesial septum in the dorsal valve of *T. Liardensis* are suggestive of the idea that when the characters of the interior of both valves are better known, the shell may have to be referred to the genus *Waldheimia.*

MOLLUSCA.

LAMELLIBRANCHIATA.

MONOTIS SUBCIRCULARIS, Gabb.

Plate 17, figs. 3 and 3 a.

Monotis subcircularis, Gabb. 1864. Palæont. Californ., vol. I., p. 31, pl. 6, figs. 29, 29 a.

Pseudomonotis subcircularis, Mojsisovics. 1886. Arktische Triasfaunen, p. 123.

Perhaps=*Pseudomonotis ochotica*, Keyserling. (Sp.)

Cfr. *Avicula ochotica*, Keyserling, 1848, in v. Middendorf's "Reise in den äussersten Norden u Osten Siberiens," St. Petersburg, band 1, theil 1, p. 257, taf. 6, fig. 15-17.

Pseudomonotis ochotica (Keyserling). Mojsisovics. Op. cit., p. 116, taf. 17, fig. 1-15, and taf. 18, fig. 15-17.

A few miles above Fossil Point on the Peace River, in lat. 56° 10′ and long. 122° 10′, A. R. C. Selwyn, 1875. Fossil Ridge, Upper Pine River, in lat. 55° 30′ and long. 122°, J. Hunter, 1877. Whipsaw Creek, head-waters of the Similkameen, Dr. G. M. Dawson, 1877: a few obscure specimens, which are referred to this species with some doubt. South side of Skidegate Channel, Q.C.I., a mile and a half west of Log Point; G. M. Dawson, 1878.

The specimens, though characteristic and easily recognisable, are for the most part imperfect, except those from the locality first mentioned. Among these latter there are several nearly perfect and well-preserved right valves, two of which are represented on Plate 17, as only the left valve of *M. subcircularis* has been figured by Mr. Gabb.

The specimens from British Columbia are as often obliquely sub-ovate and longitudinally elongated as subcircular in outline, but the "rounded upper end of the anterior margin," which Mr. Gabb states is the "most obvious difference between his species and *M. salinaria*," appears to be a constant character of the former.

In his memoir on the Arctic Trias Fauna, Mojsisovics expresses the opinion that *M. subcircularis* belongs to the genus *Pseudomonotis* of Beyrich, and that it is probably identical with *P. ochotica*. The specimens of *M. subcircularis* collected by Dr. Selwyn on the Peace River certainly bear a very close resemblance, both in general form and in sculpture, to some of Mojsisovics' figures of *P. ochotica*, but in these figures both valves and more especially the right valves are represented as provided with a minute and spine-like anterior auricle, the existence of which is not satisfactorily shewn in any of the Canadian specimens.

MONOTIS OVALIS. (N. Sp.)

Plate 17, fig. 4.

Left valve (the only one known) compressed, but moderately tumid in the umbonal region. General outline rather broadly subelliptical but slightly inequilateral: height about one-fourth greater than the length: cardinal margin very short.

Anterior side a little shorter than the posterior, its margin much less convex and nearly straight and vertical or slightly sinuous above the middle: posterior margin regularly and broadly rounded: pallial border also regularly but narrowly rounded. Superior border sloping obliquely, convexly and rapidly downward behind the beak, higher and nearly straight for a short distance immediately in front thereof: anterior cardinal angle less broadly rounded off than the posterior:

beak small, depressed, incurved and subcentral, but placed a little in advance of the middle.

Surface marked by flat, radiating ribs, which broaden outwards rather rapidly in the central portion of the valve. At and near their outer termination, the central ribs are distinctly broader than the spaces between them. The whole of the ribs are invariably simple and entire, but occasionally, though very rarely, a single and very narrow rib is intercalated between two of the broader costæ. Characters of the interior of the valves unknown.

Dimensions of the only specimen collected: maximum length, sixteen millimetres; greatest height of the same, twenty-one mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a perfect and well-preserved left valve.

This species seems to be well characterized by its broadly elliptical form and flattened radiating ribs. It is apparently most nearly related to the *Monotis boreas* of Oberg,[*] from the Trias of Spitzbergen (which Mojsisovics says is a *Pseudomonotis*) and to the *Pseudomonotis scutiformis* of Teller[†], from the Trias of Eastern Siberia, but both of these species are nearly circular in marginal outline and ornamented with a sculpture quite different from that of *M. ovalis*.

HALOBIA (DAONELLA) LOMMELI, Wissman.

Halobia Lommeli, Wissman.—1841. Beitr. Petref., IV. Heft 22, tab. 6, fig. 11.
" " Horness.—1855. Densk. Kais. Akad. Wissensch. IX, 52, taf. 2, fig. 17.
Avicula pectiniformis, Catullo.—1847. Prodr. Pal. Alpi. Ven., 73, pl. 1, figs. 1, 2. 3.
Posidonomya Lommeli, d'Orbigny.—1840. Prodr. du Paleont. Stratigr. Univ. I., 201.
? *Halobia dubia*, Gabb.—1864. Palæont. Californ., vol. I, p. 30, pl. 5, figs. 28 a, b.
Daonella dubia, Mojsisovics.—1874. Ueber der Triasch. Pelecyp. Gatt. Daonella und Halobia, p. 22.
Halobia (*Daonella*) *Lommeli*, Meek.—1877. U.S. Geol. Expl. 40th Par., vol. IV, p. 100, pl. 10, fig. 5.

South side of Houston Stewart Channel, Q.C.I., nearly opposite Rose Harbour, G. M. Dawson, 1878; and Liard River about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a few detached but almost invariably imperfect valves of a *Halobia* (or *Daonella*) with subcentral beaks and broad, flat, radiating ribs. These agree very well with the description and figure of the Nevada shell which Meek has identified with the *H. Lommelli* of European authors.

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[*] Om Trias-Försteningar frän Spetsbergen. Kongl. Svensk. Vetensk.-Akad. Handl., Bandet 14, No. 14, p. 17, Taf. 5, figs. 5 a, b.

[†] Arktische Triasfaunen. Mem. de l'Acad. Imper. des Sciences de St. Pétersbourg, VII Series, Tome XXXIII, p. 125, pl. 19, figs. 3 a, b.

Small slabs of limestone, covered with numerous valves of a *Halobia* which may possibly represent an extreme local variety of this species, were collected by Dr. Dawson in 1878 at Section Cove, north end of Barnaby Island, Q.C.I., and in 1885 in a bay five miles west of Cape Commerell, at the north end of Vancouver Island. The specimens from these two last mentioned localities differ from those from Houston Stewart Channel in having much finer radiating ribs, which, however, are flattened and broader than the fine linear grooves between them,—and in the circumstance that the beaks are usually, though not always, placed much farther forward. As already remarked (on page 127), similar specimens were collected by Mr. J. W. McKay at Glenora on the Stikine River.

HALOBIA OCCIDENTALIS. (N. Sp.)

Plate 17, figs. 5 and 6.

Left valve (the only one that has been recognized with any certainty) rather strongly convex, especially in the umbonal region: slightly inequilateral and a little higher than long: marginal outline subovate, somewhat pointed below, broadest a little above the middle, but truncated distinctly and transversely at the hinge line above. Posterior margin broadly rounded: anterior side a little shorter than the posterior, the upper half of its margin nearly straight, vertical, and at length forming a nearly rectangular junction with the cardinal border above: pallial border narrowly rounded or obtusely pointed a little in advance of the midlength. Cardinal border straight, very little shorter than the maximum length of the valve: posterior cardinal angle rounded off, the anterior subangular: beak moderately prominent, appressed and placed a little in front of the middle.

Surface marked by numerous thread-like, radiating raised lines, which are narrower and often very much narrower than the spaces between them, especially on the lower half of the posterior side of the shell. Characters of the interior of both valves unknown.

Dimensions of the type specimen: maximum length, twenty-two millimetres; greatest height, twenty-five mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: one perfect and well-preserved cast of the interior of a left valve.

At the same locality and date two other specimens were collected, both of which are probably referable to the present species. The first of these (fig. 6) is a small piece of rock, upon one of whose surfaces a well-preserved cast of the interior of the basal portion of a left valve and a similar cast of a right valve, with the anterior margin broken off, are exposed to view. In this specimen the right valve is conspicuously flatter than the left, and the height of both is obviously greater than their maximum length. The second, which is most likely only a transversely elongated form of the species, is a nearly perfect but not very well-preserved cast of the interior of the left valve. This differs from the type specimen in being much more distinctly inequilateral, in being a little longer than high, in its more broadly rounded pallial border, and in the circumstance that its anterior cardinal angle is more rounded. Should the whole of these specimens prove to belong to the same species, the original diagnosis of the characters of the latter will, of course, have to be considerably modified, but in the meantime it is thought most prudent to select the most perfect example collected as the type, and to describe it first without reference to any of the others.

TRIGONODUS (?) PRODUCTUS. (N. Sp.)

Plate 17, figs. 7, 7a and 7 b.

Shell small and slightly compressed at the sides, the maximum thickness through the closed valves being a little less than their greatest height, very inequilateral, longer than high and narrowly subovate in marginal outline, valves closed all round, not gaping at either extremity. Anterior side short and regularly rounded at its margin: posterior side much longer and narrowing gradually to a point which is more or less obtuse in different specimens, some of which are more elongated and more narrowly pointed behind than others: ventral margin gently convex, most prominent in or a little in advance of the middle, rounding upwards rather abruptly in front and somewhat straighter behind: superior border sloping gradually downward behind the beaks and very rapidly so in front of them: umbones broad and projecting very little, if at all, above the highest level of the cardinal border: beaks small, depressed, curved inward, downward and forward, and placed near the anterior end: escutcheon or ligamental area (?) lanceolate and tolerably well-defined: lunule none.

Surface marked by numerous concentric and impressed lines of growth, most of which are not visible without the use of a lens. Test apparently thin. Characters of the interior of both valves unknown.

Dimensions of one of the specimens figured (a right valve): maximum length, eight millimetres; greatest height, five mm.; of the other (a left valve)—length, seven millimetres; height, five mm.

Liard River, about thirty miles below Devil's Portage, R. G. McConnell, 1887: five detached left valves, one right valve and a small but nearly perfect cast of the interior of both valves.

This little shell is only provisionally and very doubtfully referred to the genus *Trigonodus* of Sandberger, on account of a certain general resemblance which it bears, both in shape and surface markings, to the *T. Sandbergeri* of Alberti, from the Trias of Würtemburg.

In the entire absence of any knowledge of the hinge dentition, muscular impressions or pallial line of the specimens collected by Mr. McConnell, it is not only doubtful to what genus or family but even to what order they should be referred. On first studying them, the writer was struck with their similarity in external characters to the *Nucula elongata* of Oberg, from the Trias of Spitzbergen, and Professor Hyatt, who has since examined two of the most perfect ones, thinks that they bear a similar resemblance to two or three species of *Nucula* from the European Trias, described by Klipstein, Münster and Wissman. But, so far as the writer has been able to observe, there are no indications or traces of the peculiar, comb-like, interlocking teeth of *Nucula* in any of the specimens from the Liard River, and there are some reasons for supposing that in the latter the ligament was external. If the present species should prove to be a *Nucula* rather than a *Trigonodus*, then, in accordance with the known relations of the animal to its shell in living representatives of the former genus, the shorter side of the two would be the *posterior*, and vice versâ, and the beaks would point backwards.

GASTEROPODA.

MARGARITA TRIASSICA. (N. Sp.)

Plate 17, figs. 8 and 8 a.

Shell small, globosely turbinate and about as broad as high: whorls four, increasing rapidly in size, the latter ones ventricose but flattened next to the suture above: spire apparently a little shorter than the outer whorl, which latter is depressed in the centre below and rather narrowly umbilicated, the umbilicus being somewhat deep, with a broadly rounded margin and about one-third the diameter of the base: suture distinct and nearly rectangular: aperture nearly circular but apparently somewhat pointed above and a little sinuous on the columellar side: outer lip thin and simple.

As viewed in its dorsal aspect the last whorl of the spire is seen to be encircled by three rather distant raised lines or minute spiral ridges, one of which is placed on the shoulder above, one in the middle and one close to the suture below. The outer whorl bears four rather distant spiral, raised lines on its upper half, and below these there are a number of others which are finer and much more closely disposed. When examined with a lens, the whole of this spiral sculpture is seen to be crossed and overlaid by densely crowded and exceedingly minute raised striæ. Test extremely thin.

As the apex is broken off in each of the few specimens collected, it is not practicable to give the exact proportionate dimensions of any.

Liard River, about thirty miles below Devil's Portage, R. G. McConnell, 1887: four casts of the interior of the shell, in two of which portions of the test are well preserved.

It is possible that this shell may not be a true *Margarita*, but it seems to be more closely allied to the *M. spiralis* of Münster, from the Trias of St. Cassian, as figured by Zittel, than to any other genus known to the writer. Professor Hyatt, who has examined two of the best specimens collected by Mr. McConnell, thinks that they resemble the *Turbo Johannis Austriæ* of Klipstein (figured in Stoppani's "les Pétrifications d'Esino," pl. 14, fig. 16), but that "they are not quite so elevated, their whorls are flatter above and their spiral ridges better marked." It is, however, quite evident that they cannot be referred to the genus *Turbo* as now restricted, and it is most likely that their affinities are rather with the Trochidæ than the Turbinidæ.

CEPHALOPODA.

NAUTILUS LIARDENSIS. (N. Sp.)

Plate 18, figs. 1 and 1 a.

Shell broad, subglobose, but deeply though rather narrowly umbilicated: maximum breadth of the aperture about equal to the entire length, as measured from the centre of the outer lip to a corresponding point on the periphery of the opposite side. Volutions very closely embracing, the inner ones almost completely covered, the outer one increasing rapidly in size, but expanding much more rapidly in a lateral than in a dorso-ventral direction: periphery somewhat flattened, but probably abnormally so: sides and umbilical margin both rounded, the latter not at all angular: aperture a little more than twice as broad as high, transversely subreniform, or transversely and broadly elliptical but shallowly emarginate in the centre of the base by the encroachment of the preceding volution.

Septa somewhat closely approximated, their average distance apart on the periphery, where their margins are nearly straight, being about six millimetres. Position of the siphuncle unknown.

Surface apparently almost smooth, and marked only by transverse striæ of growth.

Dimensions of the only specimen collected: maximum length, fifty-seven millimetres; maximum breadth at the aperture, where the shell is broadest, fifty-eight mm.; height of aperture in the centre, twenty-seven mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a slightly distorted cast of the interior of the shell, with small portions of the test preserved, but with the greater portion of the chamber of habitation broken off. The number of septa whose margins are visible in this specimen is twenty-one, and the portion of the body chamber that remains is about three-quarters of an inch in length.

This shell appears to bear such a close resemblance to the *Nautilus Sibyllæ* of Mojsisovics,* from the Trias of Spitzbergen, in almost every respect, that it may possibly prove to be only a local variety of that species. Still, in the figures of *N. Sibyllæ* the umbilical margin is represented as rather distinctly angular, whereas that of *N. Liardensis* is very regularly rounded.

POPANOCERAS MCCONNELLI. (N. Sp.)

Plate 18, figs. 2, 2 a, b, and 3, 3 a.

Typical Form. (Figs. 2 and 2 a, b.) Shell globosely sublenticular, but always a little depressed in the umbilical region: greatest thickness or breadth varying in different specimens from a little more to a little less than half of the maximum diameter: umbilicus well defined and rather deep, with steep sides, but very narrow and rather less than one-eighth of the maximum diameter, in adult specimens. At a very early stage of growth, however, the umbilicus is much wider proportionately. Thus, in a specimen whose maximum diameter is fourteen millimetres, the umbilicus is about six mm. in width and the inner volutions are partly exposed. In adult specimens the outer volution is so closely embracing that the whole of the inner whorls are covered. Sides of the outer volution narrowing rapidly and convexly from the umbilical margin to the periphery, which latter is somewhat obtusely but very distinctly angulated. Aperture very narrow in a dorso-ventral direction, angular above, widening rapidly and convexly to the base, which is deeply and broadly emarginated by the encroachment of the preceding volution. If measured in the centre, where the emargination is deepest, the height of the aperture is not more than one-half of its maximum length, but if measured outside of the emargination its height is a little greater than its breadth.

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* Arktische Triasfaunen (Mem. l'Ac. Imp. des Sciences de St. Pétersbourg, Ser. VII, Vol. 33, No. 6), p. 100, pl. 16, fig. 2.

Surface nearly smooth, marked only by rather distant but somewhat irregularly disposed and very indistinct spiral striations, which are crossed by almost equally indistinct and very slightly elevated transverse plications. The faint revolving striæ are most strongly marked on the outer half of the sides and become obsolete near the umbilical margin, while the low, transverse plications or wrinkles are usually, though not always, nearly straight and widen outwards towards the periphery, over which they do not pass.

Sutural line consisting of six simple saddles on each side of the siphonal saddle, and of six simple lobes on each side of the siphonal lobe. The apex of the very small siphonal saddle has a minute notch in the centre, but all the other saddles are quite entire at their margins. The siphonal saddle is less than half the height of the first and second lateral saddles, which are larger than the rest and about equal in size to each other and to the corresponding lobes, while the third, fourth, fifth and sixth lateral saddles are all very small and much shorter than the first or second. All the lobes are minutely incised at their margins. The siphonal lobe, which is rather deeply emarginated in the centre by the small siphonal saddle, is broader but not quite so high as the first lateral lobe, which latter is a little higher than the second. The third, fourth, fifth and sixth lateral lobes are all very small and much shorter than the second.

The septa are closely approximated, and as the sutural lines of only two or three contiguous septa are visible in specimens in which a not inconsiderable portion of the outer lip is broken off, it seems clear that when perfect the chamber of habitation must have been large and that it must have occupied fully the whole of the outer volution.

Dimensions of the largest undistorted specimen collected: maximum diameter, fifty-one millimetres; greatest breadth or thickness, twenty-seven mm. and a half; width of umbilicus, six mm. In a larger but slightly distorted specimen, the maximum diameter is not quite seventy mm.

Variety lenticulare. (Figs. 3 and 3 a.) Shell sublenticular, but always a little depressed in the umbilical region: greatest breadth or thickness equal to one-third of the maximum diameter: umbilicus very narrow and indistinctly defined, in some specimens almost closed: periphery acutely angulated: aperture much narrower laterally than in the typical form.

Surface nearly smooth, marked only with fine radiating striæ, which are doubly flexuous on each of the sides and produced into a series of obtuse, beak-like projections which arch forwards on the periphery.

Sutural line apparently similar to that of the typical form.

Dimensions of the largest specimen of this variety known to the writer: maximum diameter, sixty millimetres; greatest breadth of the same, twenty mm.

It is only proper to add that the typical and convex form and the flattened variety *lenticulare* are connected by numerous intermediate gradations both in form and sculpture.

Liard River, about twenty-five miles below Devil's Portage, also about thirty miles below the same portage, R. G. McConnell, 1887. At the first mentioned locality five specimens were collected, of various sizes, most of which belong to the typical and convex form of the species. At the second locality indicated, seventeen specimens were collected of all sizes, varying from eight to about sixty millimetres in their greatest diameter. Eight of these have a maximum diameter of more than an inch and a half, and of these four belong to the typical form and four to the variety *lenticulare.*

The genus *Popanoceras* was first proposed and its characters defined by Professor Hyatt, in 1884, in the twenty-second volume of the Proceedings of the Boston Natural History Society, on page 337. The types of the genus are there stated to be the *Goniatites Kingianus*, *G. Koninckianus* and *G. Soboleskyanus* of Murchison, De Verneuil and Keyserling, from the Dyas (or Permian formation) of Russia. In 1886, on pages 67-72 and plates 14 and 15 of his "Arktische Triasfaunen," Mojsisovics described and figured four named* and two unnamed additional species from the Upper Trias of Spitzbergen. The present species, which the writer has much pleasure in associating with the name of its discoverer, may be readily distinguished from the whole of these previously characterized forms by its much larger size and more especially by its more or less convexly sublenticular form and very distinctly angulated periphery.

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* *P. Hyatti, P. Torelli, P. Malmgreni* and *P. Verneuili.*

ARCESTES GABBI, Meek.

Ammonites Ausseanus, Gabb.—1864. Palæont. Californ., vol. I., p. 25, pl. 3, figs. 11 and 17 (not of Hauer, teste Meek).

Arcestes Gabbi, Meek.—1877. U.S. Geol. Expl. 40th Parallel, vol. IV, pt. I, p. 121, pl. 10, figs. 6, 6 a and 6 b.

Bay five miles and a half west of Cape Commerell, north end of Vancouver Island, G. M. Dawson, 1885: one tolerably perfect specimen and a few fragments of others.

A nearly perfect but considerably crushed and distorted specimen of an *Arcestes*, collected by Dr. Dawson in 1878 at Houston Stewart Channel, in the Queen Charlotte Islands, has been referred to this species by the writer, in the Report of Progress of the Geological Survey of Canada for 1878-79, but its specific relations are somewhat doubtful.

ACROCHORDICERAS (?) CARLOTTENSE. (N. Sp.)

Plate 19, fig. I.

The foregoing name is suggested provisionally for a remarkably sculptured shell, of which two rather large fragments, which Professor Hyatt thinks are "probably specimens of *Acrochordiceras*," were collected by Dr. Dawson in 1878 at Houston Stewart Channel, Q.C.I.

The larger of these two fragments is a piece of the outer volution about twenty-seven millimetres high in its dorso-ventral diameter, about thirty-five mm. in length from the posterior to the anterior termination and twelve mm. in thickness near the periphery.

The outer volution seems to have been strongly compressed at the sides, the umbilicus appears to have been narrow and in both specimens the periphery or abdominal region is distinctly flattened. At and near the posterior termination of each of these fragments, the ribs or pilæ are frequently bifurcating and in one instance bidichotomous, but in their anterior halves the ribs are broken up into numerous, short and simple, transversely elongated tubercles.

These specimens, Professor Hyatt writes, "are interesting in so far as they exhibit a style of sculpturing which is different from that of any Triassic form I have ever seen either upon a specimen or figured. They both at an earlier stage evidently had divided pilæ, but these at the stage of growth represented in both these fragments have begun to be resolved into numerous, short and elongated, interrupted folds. The style of this makes the larger of the two fragments a close copy of some Scaphites of the Cretaceous. Even the large and extremely aged specimens of *Acrochordiceras* figured by Mojsisovics retain the entire trachyceran pilæ, and in part the tubercles or at least indications of them. It is very evident that in this species a marked change takes place either upon the transient living chambers of the adults or upon the latter part of the last whorls in extreme age. It is evident, also, that the changes proceeded from the umbilical shoulders outward, and that the continuous pilæ probably entirely disappeared within a short space. I did not succeed in cleaning the abdomen satisfactorily and therefore cannot say positively that the pilæ or ribs cross it as in *Acrochordiceras*. The species is certainly new, so far as I can judge."

TRACHYCERAS CANADENSE. (N. Sp.)

Plate 18, figs. 4 and 4 a.

Shell compressed at the sides and a little the thickest around the umbilical margin: periphery or abdominal region broad and flattened, but rounded at its junction with the sides and encircled in the centre by a deep, narrow groove or abdominal channel. Volutions rather strongly involute, the umbilicus occupying about one-fourth of the entire diameter: maximum breadth of the outer whorl a little less than its dorso-ventral diameter as measured from the umbilical margin to the outer boundary of the abdominal channel: umbilical margin distinct and subangular: inner wall of the umbilicus steep.

Surface of the outer volution marked by transverse ribs which are ornamented by rows of closely arranged tubercles. On the inner half of each side the ribs are nearly straight or but slightly flexuous, but on the outer half they curve concavely forwards in such a way as to form a series of obtusely pointed or narrowly rounded linguiform processes on the periphery, in the centre of which, however, they are invariably cut through by the narrow abdominal channel. Many of the ribs bifurcate from a tubercle placed on the umbilical margin, and these bifurcating ribs, which extend outward to the abdominal channel, usually alternate with one or two simple ribs of similar length. On the outer half of each side, one or both of the branches of these bifurcating ribs occasionally divides again, and in other cases a short rib, which itself bifurcates near or upon the abdominal region, is intercalated between the two branches. In one instance, also, a short, bifurcating rib alternates with a similar but much longer one. On each side of the peripheral or abdominal groove the longer ribs, whether simple or bifurcating, bear transversely elongated tubercles, one of which is placed on the umbilical margin, six next to it, one at the junction of the side with the periphery, and one, which appears to be divided into two points, next to the abdominal groove.

The sutural line consists of three lateral saddles on each side of the siphonal saddle, and of two principal lateral lobes, besides a third and minute lobe, which is partly sunk in the umbilical cavity, on each side of the siphonal lobe. The margins of all the saddles are rounded and entire, but those of the lobes appear to be minutely incised. The siphonal saddle is much smaller than any of the rest; the first and second lateral saddles are nearly equal in size and a little larger than the third. The siphonal lobe, whose summit is shallowly emarginate in the centre by the small siphonal saddle, is a little larger than the first lateral lobe, and it again is slightly larger than the second lateral.

Dimensions of the only specimen collected: greatest diameter, fifty millimetres; maximum breadth or thickness, twenty mm.; greatest breadth of umbilicus, thirteen mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: one tolerably well preserved and nearly perfect cast of the interior of the shell.

According to Professor Hyatt, this specimen belongs to the group of the *Trachycerata margaritosa* of Mojsisovics. "It is closely allied to *Trachyceras Aon*, Mojs. (Ceph. der Med. Triaspr., p. 133, pl. 21, figs. 1–38), but differs therefrom in the number of rows of closely arranged tubercles, in its broad abdomen and the division of the spines of the abdomen into two points. It is like *P. ladinum*, Mojs. (Ib., pl. 14, fig. 2), but has more rows of tubercles, and these smaller; also like *T. Judicaricum*, Mojs. (Ib., pl. 14, fig. 3), but is more involute. It is also like *T. longobardicum* (Ib, pl. 19, fig. 4), but is different in the sutures and has smaller ribs and tubercles."

In the writer's judgment the specimen now under consideration appears to be still more closely related to the Nevada fossil which has been referred to *T. Judicaricum* in the fourth volume of the United States Geological Exploration of the Fortieth Parallel, on the authority of Professor Hyatt, who, however, now doubts the correctness of this identification, as will be seen from the following extract from a letter of his to the present writer, dated March 20th, 1888:—"At the time that I wrote the note for Meek in Geol. Expl. 40th Parallel, vol. iv, p. 118, I was disposed to give greater latitude to specific characters than I am now. I should not, I think, now consider the shell there described as *T. Judicaricum*. If Meek's figures are at all correct, the nodes and pilæ (ribs) are distinct, as are also the involution and channel. Your specimen, if I remember rightly, differed from Meek's in having very much finer pilæ (ribs), many rows of closely set tubercles, and the tubercles on the abdomen had two points so closely set as to look like parts of one big tubercle, or as if they had originated from some such division of a large tubercle."

ARNIOTITES, Hyatt. (Gen. nov.)

(=Balatonites arietiformes. Mojsisovics.)

Shell discoidal, whorls moderately numerous, strongly compressed at the sides, everywhere in close contact, but very slightly embracing, so that the umbilicus is wide and open and almost the whole of the inner volutions is exposed to view: periphery simply carinated, "keel single, smooth, with slight linear channels on either side, or none, according to the species:" surface of the outer whorls simply costate. "The pilæ (ribs) arise from folds and are smooth, perfectly developed, straight on the sides, bending forward at the geniculæ, which are sometimes noticeably prominent. The sutural line has not been seen, but, judging by analogy, the lobes were probably dentate and the saddles smooth."

In reference to this genus Prof. Hyatt writes as follows: "The careful examination of the specimens collected by Dr. Dawson convinced me of what I had long suspected, that the genus *Balatonites* of Mojsisovics contains three distinct genera. This eminent authority had, in fact, himself clearly seen and distinguished three groups, but did not consider them to be of generic rank. The shells of Balatonites arietiformes, Mojsis. (Ceph. der Mediterr. Triaspr.) have complete pilæ without tubercules, and entire keels in the young, and the latter are only very slightly, if at all, ridged in adults. I propose for this group the name of *Arniotites*, in allusion to the close resemblance of the shells to the *Arnioceras* of the Lias, a fact first noticed by Mojsisovics.

The type of Mojsisovic's genus is *Balatonites Balatonicus* (V. 1, kürse Uebers d. Amm.—Gattun. d. Mediterr. u. juvav. Trias; Verh. d. k. k. Reichsan., 1870, No. 7, p. 139). This belongs to the second group, the Balatonites gemmati. These shells have heavily tuberculated pilæ, a line of tubercles replaces the keel and they resemble *Trachyceras* in general aspect. The sutures are similar to those of *Arniotites*, the lobes being dentated and the saddles smooth.

Mojsisovics' third group, the Balatonites acuti, is the most distinct of the three. The shells have sutures with smooth lobes and saddles, true keels are not present, but the abdomens are exceedingly acute in some species. In the few species known, the whorls are much compressed and the mode of growth discoidal—the whole presenting a very unusual combination of characteristics. I propose for this group the name *Dorikranites* (from *Δορικρᾶνος*, spear-headed), the type being *Dorikranites Bogdoanus* (=Balatonites Bogdoanus, Mojsis., Ceph. der Triaspr., p. 87, pl. 80, figs. 1-4), and the following were described by Mojsisovics under the name of *Balatonites*, *Dorikranites rossicum* and *D. acutum*.

The young of *Arniotites* has a thin keel, and this, together with the form of the whorls and pilæ, shows that the more discoidal and stouter shells of *Celtites* are larval or radical forms as compared with *Arniotites*, and are probably the near allies of this series. In *Arniotites* the earliest whorls are often smooth, compressed, and are probably rounded as well as keel-less on the abdomen.* The shell during this stage must have closely resembled the adult of *Dinarites Mohamedanus*, Mojsisovics (Mediterr. Triaspr., p. 7, pl. 40), and more remotely *Ceratites Sturi* (ibid, p. 44, pl. 39), both of these being forms belonging to the direct line or stock of Ammonoid radicals which terminated in the Lias with *Psiloceras planorbe*. Among Balatonitidæ, *Arniotites*, with its smooth young, evidently bore precisely similar relations to those stock radicals of the Trias that *Arnioceras*, among the Arietidæ, bore to the stock radical, *Psiloceras*, in the Lias. *Arniotites Vancouverensis*, Whiteaves, does not approximate closely to any species described by Mojsisovics. The pilæ are straighter, the forward bend is hardly perceptible, the whorls are narrower, and the young smooth for a more prolonged period of the growth. These characters have all been exaggerated by compression, but this cannot account for the whole of the observable differences. This species is, of course, the type of the genus, and the small specimen from Crescent Inlet shews the characters best. The following species are described and figured by Mojsisovics in his great work (Ceph. der Mediterr. Triaspr.) under the name *Balatonites*; *Arniotites euryomphalus*, *A. arietiformis*, *A. prezzanus*, *A. stradanus* and *A. Meneghini*.

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* "It is quite common for species of Ammonoids to be rounded and keel-less on the abdomen, during the smooth stage, until the shell is of considerable size, and they are invariably so during the earlier part of the smooth stage. The slight crenulations of the keel, described by Mojsisovics in Balatonites arietiformes, are probably not constant in all the species and I have not considered them as of generic importance."

ARNIOTITES VANCOUVERENSIS.

Plate 19, fig. 2.

Celtites (?) *Vancouverensis*, Whiteaves.—1887. Dawson, Rep. Geol. Exam. N. pt. Vanc. Isld. and adj. coasts, in Ann. Rep. Geol. Surv. Can. for 1886, p. 110 B.

Shell small, discoidal, whorls about four in number, compressed and very gently convex at the sides, slender, increasing slowly in size and very slightly embracing, so that the whole of the sides of the inner ones is exposed to view: umbilicus wide and shallow: outer volution distinctly keeled at the periphery, the keel apparently single, entire and with a faint linear channel on each side. Surface of the first and second volution, and the inner half of the third volution apparently smooth, that of the outer half of the third and of the whole of the fourth distinctly ribbed; the ribs being simple, transverse, generally straight, broadening outward and interrupted on the keeled periphery of the outer volution.

Sutural line unknown.

In a supplement to Dr. Dawson's report, which was written more than a year before the present paper was printed, the name *Celtites*(?) *Vancouverensis* was suggested provisionally for a number of specimens collected from the Triassic rocks at three localities in the Queen Charlotte Islands, at five on or near the north or north-west coast of Vancouver Island, and at Hernandez Island, in the Strait of Georgia. With the exception of a few crushed fragments, the specimens from each of these localities are mere natural moulds or impressions in shale of the exterior of one side (or of a portion of one side) only of each shell, in which not a vestige of any part of the sutural line could be detected.

Since the original diagnosis of *C. Vancouverensis* was written, some of the most perfect specimens from most of these localities have been examined by Professor Hyatt, who is inclined to think that nearly all of them are not referable to *Celtites*, but to a new genus which is here described under the name *Arniotites*, that they may possibly be separable into two or perhaps three species, and that it is not quite certain even that they all belong to the same genus. He suggests, also, that the small specimen represented on plate 19, figure 2, be regarded as the type of the genus *Arniotites* and of the species *A. Vancouverensis*, and it is in accordance with this suggestion that the description of both has been prepared for the present paper. Professor Hyatt thinks that the most salient characters of the species as now restricted are "the smooth character of the young shell as shown in the umbilicus, the simple keel bordered on each side by a faint linear channel, and the abruptly terminating ribs on the outer volutions."

The type of *Arniotites Vancouverensis* as here defined was collected by Dr. Dawson in 1878, at Crescent Inlet, Moresby Island, Q. C. I., and six imperfect specimens, which are believed by the present writer to be referable to the same species, were obtained by Dr. Dawson in the same year at Forward Inlet, on the north-west coast of Vancouver Island, near Observatory Rock.

ARNIOTITES. (Species uncertain.)

Plate 19, fig. 3.

Celtites (?) *Vancouverensis*, Whiteaves. (Pars.) 1887. Op. cit., p. 110 B.

Six natural moulds of the exterior of one side of each shell of a species of *Arniotites* and two small and crushed fragments of casts of the interior of the test were collected by Dr. Dawson in 1885, at Robson Island, in Forward Inlet. These were supposed by the present writer to represent merely an advanced stage of growth of the preceding species. Professor Hyatt, however, who has examined the most perfect specimen from this locality, the one figured on plate 19, is of the opinion that its "whorls are proportionately broader, in an abdomino-dorsal direction, than those of *A. Vancouverensis*, that the pilæ of the former are more numerous and not so coarse and fold-like, and that they begin to be developed earlier, the young being smooth for a much shorter time than those of *A. Vancouverensis*." To the writer the pilæ of the typical *A. Vancouverensis* seem finer and closer together than those of the specimens from Robson Island.

ARNIOTITES OR CELTITES. (Species uncertain.)

Plate 19, fig. 4.

The large specimen from Forward Inlet, figured on plate 19, Professor Hyatt thinks may be "either an *Arniotites* or a *Celtites*. The numerous, narrow-sided, compressed whorls, entire keel, crowded pilæ (ribs) and discoidal form are very similar, possibly identical, with those of *Celtites Epolenensis*, Mojsisovics, figured from smaller specimens in Mediter. Triaspr., pl. 29, 38. The last part of the last whorl in the specimen collected by Dr. Dawson is curiously distorted by pressure, and the side assumes an aspect like *Arniotites*, not possessed by the earlier stages, which are not distorted. As noted by Mojsisovics, *Arniotites* and *Celtites* are undoubtedly very closely allied in some of their species, but the typical forms seem to be generically separable."

BADIOTITES CARLOTTENSIS. (N. Sp.)

Plate 19, fig. 5.

Shell small, strongly compressed at the side, periphery sharp but not distinctly keeled; whorls increasing rapidly in breadth in the dorso-ventral direction. Surface of the outer volution marked by crowded, regularly disposed and nearly equidistant, minute and falcate rib-like folds, which curve concavely forwards on each of the sides and which are apparently not interrupted on the periphery. Sutural line unknown.

South side of Houston Stewart Channel, Queen Charlotte Islands, nearly opposite Rose Harbour, G. M. Dawson, 1878: one small and very much distorted specimen, the maximum diameter of which is twelve millimetres or about half an inch.

The type and only specimen collected is so much distorted by obliquely lateral pressure that its outer volution looks much more strongly embracing than it probably was in its normal condition, and its umbilicus is made to assume an abnormally narrow appearance.

For the elucidation of the generic relations of this shell the writer is indebted to Professor Hyatt, who writes as follows in regard to it: "It is much larger than the only other known species of this genus, the *Badiotites Eryx* of Mojsisovics (Ceph. der. Mediterr. Triaspr, p. 91). After considerable trouble and some rather hazardous work, I succeeded in splitting off a part of the otherwise indeterminable shell, cleaned a part of the whorl, and traced the well-known pilæ of *Badiotites* running continuously across the abdomen of the much compressed and acute whorl. The extreme flatness, of course, may be in a measure accounted for by pressure, but the agreement in aspect of the whorls and the continuity of the pilæ leave hardly any room for doubting that it is a form of *Badiotites*. It is much larger than *B. Eryx*, and probably new."

AULACOCERAS CARLOTTENSE, Whiteaves.

Plate 19, fig. 6.

Aulacoceras Carlottense, Whiteaves.—1887. Dawson, Rep. Geol. Exam. N. part Vanc. I., &c.; in Ann. Rep. Geol. Surv. Can. for 1886, p. 109 B.

Guard elongated, in the more perfect though smaller of the only two specimens collected, which may therefore be regarded as the type of the species, narrowly conical and increasing very slowly in thickness from the acutely pointed posterior end, whose apex is slightly excentric; in the larger but less perfect example comparatively thick, somewhat fusiform and bluntly pointed posteriorly, with the apex distinctly excentric. Alveolus and phragmocone unknown. Outer surface marked by close-set, rounded, longitudinal ribs, which are separated from each other by narrow but deep linear furrows.

In 1878 six badly preserved specimens of the guards of one or more species of Belemnites were collected by Dr. G. M. Dawson at Houston Stewart Channel, in the Queen Charlotte Islands. Of these, the two described above are both longitudinally ribbed on the outside and apparently belong to the genus *Aulacoceras* of Hauer. The smaller of the two is a natural longitudinal section of the guard, about two inches in length and not quite half an inch broad at the thickest end, while the larger, which is only a badly preserved natural mould or impression of one side of a large specimen of the guard with part of the test preserved at the posterior end, but which shows clearly one of the lateral grooves as well as several of the longitudinal ribs that are said to be characteristic of the genus, is nearly five inches in length and fully an inch and a half broad in the thickest part. Of the other four specimens two are mere fragments which cannot be determined either generically or specifically, one being a very slender guard about two inches and a half long and not quite a quarter of an inch broad at the thicker end, whose surface markings are not preserved, while the other is a piece of the posterior or pointed end of the guard of a small individual, about an inch and a quarter long and a quarter of an inch broad at the thicker end, whose surface appears to be perfectly smooth.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

4. *On some Cretaceous Fossils from British Columbia, the North West Territory and Manitoba.*

(A.) FROM THE EARLIER CRETACEOUS OF BRITISH COLUMBIA.

MOLLUSCA.

LAMELLIBRANCHIATA.

AUCELLA MOSQUENSIS, var. CONCENTRICA.

Inoceramus concentricus, Fisch. 1837. Oryctogr. de Moscou, p. 17, pl. 20, figs. 1–3.
Aucella concentrica, v. Keyserling. 1846. Petchorareise, p. 100, pl. 16, fig. 16.
Inoceramus Piochii, Gabb. 1864. Pal. Calif., vol. I, p. 187, pl. 25, fig. 173, (exclus. fig. 174).
Aucella concentrica, Eichwald (as of Fischer). 1865. Lethæa Rossica, vol. II, pt. 1, p. 521, pl. 22, figs. 3 a, b.
Aucella Piochii, Gabb. 1869. Pal. Calif., vol. II, p. 194, pl. 131, figs. 92, a–c.
Aucella concentrica, Eichwald (as of Fischer). 1871. Geogn. Palæont. Bemerk. über die Halbins. Mangisch. und die Aleutischen Inseln, p. 186, pl. 17, figs. 1 and 2.
Aucella concentrica, White (as of Fischer). 1884. Bull. U. S. Geol Surv., No. 4, p. 13, pl. 6, figs. 2–12.

Tatlayoco Lake, B.C., G. M. Dawson, 1875. Banks of the Upper Skagit River, B.C., G. M Dawson, 1877, and Browning Creek, Forward Inlet, Quatsino Sound, north west coast of Vancouver Island, G. M. D., 1878.

Long Island, Harrison Lake, B.C., also west shore and peninsula on the south-east shore of the same lake, and Chilliwack River, near Tamiahai Creek, B.C., A. Bowman, 1882.

Browning Creek, Forward Inlet and west side of Winter Harbour in Forward Inlet, also Raft Cove on the west coast of Vancouver Island, north of Quatsino Sound, V.I., G. M. Dawson, 1885.

West of Fraser River, B.C., a little to the north of sources of Bridge

River, B.C., from a mountain six or seven thousand feet high above sea level, Mr. Soues (per Mr. T. Elwyn), 1886. South Fork of Quesnel River, near the foot of Quesnel Lake, A. Bowman, 1886.

Porcupine River, N.W.T., in latitude 67° 8′ N. and longitude 137° 47′ W.; also Yukon River, Alaska, eight miles below the Antoine River, in latitude 65° 15′ N. and longitude 141° 40′ W.; R. G. McConnell, 1888. Extremely abundant at most of these localities.

The specimens from each of these localities are undoubtedly conspecific with the *Aucella Piochii* of Gabb from the Shasta Group of California, and with the fossils from the Cretaceous rocks of Alaska which Dr. C. A. White regards as a variety of the *A. concentrica* of Fischer. In the Lethæa Rossica, however, Eichwald has expressed the opinion that *A. concentrica* is not specifically distinct from the *A. Mosquensis* of von Buch, and the writer has long been convinced that *A. Piochii* also is only an inconstant varietal form of A. *Mosquensis.* The names *A. concentrica* and *A. Piochii* have been given with the view of distinguishing comparatively broad specimens whose valves are almost equally convex, from the typical *A. Mosquensis,* which is narrowly elongated and whose right valve is flatter than the left, but a study of some three or four hundred Aucellæ from various localities in British Columbia has led to the conclusion that the most dissimilar examples are connected by every kind of intermediate gradation. A careful comparison of Dr. White's illustrations of the Alaskan fosssils which he refers to *A. concentrica* with Eichwald's figures of specimens of *A. Mosquensis* from Alaska and the Aleutian Islands, will be sufficient to shew how difficult if not impracticable it is to discriminate between these nominal species.

By some writers the Aucella-bearing deposits of Russia have been regarded as of Jurassic age, and by others as of Cretaceous. D'Orbigny refers them to his "étage Oxfordien," Trautschold and Rudolph Ludwig to the Tithonic system of Oppel, and Eichwald to the Upper Neocomian. Ever since 1875, the year in which Aucellæ were first discovered in British Columbia, the present writer has been convinced that the rocks in which they are the prevalent fossil, in that province as well as in California, are of Cretaceous age. In the Transactions of the Royal Society of Canada for 1882, the opinion was expressed that these rocks are probably of the horizon of the Upper Neocomian. At the time that this paper was written, not more than eight species in a sufficiently perfect state for identification or description had been found associated with the Aucellæ in British Columbia, and of these, only two (viz., *Ancyloceras Remondi* and *Syncylonema Meekiana*), besides the *Aucella*, were recognized as occurring also in the "Lower Shales and Sandstones, or Subdivision C" of the Cretaceous rocks of the

Queen Charlotte Islands.[*] The more recent collections made by Dr. Dawson from the Aucella-bearing rocks of British Columbia, and reported on in the present paper, shew that ten fairly recognizable species are associated with the Aucellæ in that province, and that of these, two, (viz., *Astarte Carlottensis* and *Yoldia arata*), besides the two already mentioned, or, counting the *Aucella*, five out of the entire eleven are common to these deposits and to Subdivision C of the Cretaceous rocks of the Queen Charlotte Islands. Moreover, the fragment of an Ammonitoid shell to which the name *Olcostephanus Quatsinoensis* was given, in the paper to which reference has been made, proves to be a portion of a small Scaphite, closely allied to the *S. æqualis* of Sowerby, from the English Upper Greensand, and the *Pholadomya Vancouverensis* described and figured in the same paper is possibly only a form of the *Pleuromya Carlottensis* from the Queen Charlotte Islands, in a peculiar and unusual state of preservation. The present writer has long entertained the opinion that the "Lower Shales" (C) of the Queen Charlotte Islands Cretaceous are the homotaxial but by no means necessarily the contemporaneous equivalents of the Gault of England and Europe, and it now seems most probable that the rocks in British Columbia in which Aucellæ are the prevalent fossils, are of the same age as the deposits first mentioned rather than a little older.

When the acute inflection of the anterior margin of the right valve immediately under the beak, is not apparent, as is often the case, it is very easy to mistake an *Aucella* for a small species of *Inoceramus*, and if, as Eichwald suggests and as the figures and descriptions would seem to imply, the *Inoceramus Coquandianus* of d'Orbigny, which is described and figured in the "Paléontologie Française" and the "Paléontologie Suisse," be identical with one of the varietal forms of *Aucella Mosquensis*, then in Europe also Aucellæ would rank among the characteristic fossils of the Gault.

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[*] In this connection it may be well to quote the scheme of classification of the Cretaceous rocks of these islands which was published by Dr. Dawson in 1880 and based upon stratigraphical and lithological grounds, though, as has been elsewhere stated, it does not seem practicable to separate subdivisions C, D, and E on purely palæontological considerations.

Subdivisions of the Cretaceous Formation in the Queen Charlotte Islands, in descending order.

A.	Upper Shales and Sandstones	1,500	feet.
B.	Coarse Conglomerates	2,000	"
C.	Lower Shales and Sandstones, with coal	5,000	"
D.	Agglomerates	3,500	"
E.	Lower Sandstones	1,000(?)	"
	Total	13,000	"

A and B being regarded as Later and C D and E as Earlier Cretaceous.

YOLDIA ARATA, Whiteaves.

Yoldia arata, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 233, pl. 31, figs. 4 and 4*a*.

East side of Winter Harbor, Forward Inlet, G. M. Dawson, 1885: a few casts of the interior of the shell of a small *Yoldia*, which are somewhat doubtfully referred to this species.

ASTARTE CARLOTTENSIS. (N. Sp.)

Astarte Packardi, Whiteaves (as of White). 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 229, pl. 30, figs. 6, 6a and 6b; but possibly not *A. Packardi*, White, 1880, U. S. Geol. Surv., Contr. to Palæont., Nos. 2-8, p. 149, pl. 37, figs. 6a and b.

Shell moderately convex, somewhat compressed at the sides, very inequilateral: marginal outline varying in different individuals from subcircular to transversely subovate: length and height equal in the subcircular specimens, whereas in the transversely subovate examples the length exceeds the height by rather more than one fourth: hinge margin descending abruptly and concavely in front and convexly and much more slowly behind: umbonal region somewhat tumid, beaks not very prominent, directed forwards and placed about half way between the centre and the anterior margin.

Surface marked by numerous and regularly disposed, narrow and acute concentric ribs or plications, and by minute striæ of growth.

The hinge dentition consists of two transverse cardinal teeth in each valve but there are no lateral teeth. In the right valve both teeth are most prominent in the middle, but the posterior cardinal tooth is triangular in outline and larger than the anterior. The inner margin of the valves below and at the sides is simple in some specimens and distinctly crenulated in others.

In a large specimen with nearly circular outline the maximum length and height are both thirty millimetres; in a transversely elongated specimen, the length is twenty-six mm., and the height twenty.

East side of Alliford Bay, Moresby Island, Q,C.I.; four large and beautifully preserved specimens with the test preserved, and a few fragments: south side of Alliford Bay; abundant in the condition of small but perfect casts: east end of Maud Island, in Skidegate Channel, Q.C.I., five small samples with the test preserved: all collected by G. M. Dawson in 1878.

The three or four imperfect and badly preserved casts from the felsites of the Iltasyouco River, B.C., which were provisionally identified with the *A. ventricosa* of Meek on page 155 of the Report of Progress of the Geological Survey of Canada for 1876-77, most probably belong to the present species.

Some imperfect valves of an *Astarte* collected by Dr. Dawson in 1885, on the east side of Winter Harbour, Forward Inlet, Vancouver Island, can also be scarcely distinguished from *A. Carlottensis.*

This species belongs to a typical and persistent section of the genus *Astarte*, which has ranged from the Liassic period up to the present time with very little variation in form or surface markings, and which is consequently very difficult to separate into well defined species. It agrees so well with the description and figures of *A. Packardi*, White, that it was at one time somewhat confidently identified with that species, but as Dr. White, who has examined some of the most perfect specimens from the Queen Charlotte Islands, thinks that it is most probably distinct therefrom, it seems necessary to distinguish it by a new specific name.

OPIS VANCOUVERENSIS, Whiteaves.

Opis Vancouverensis, Whiteaves. 1879. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 158, pl. 18, figs. 4 and 4*a*.

West end of Lasqueti Island (in the Strait of Georgia) near False Bay: a cast of the interior of the right valve of a shell which almost certainly belongs to this genus and most probably to this species.

PLEUROMYA LÆVIGATA, Whiteaves.

Pleuromya lævigata, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 224, pl. 30, figs. 1, 1*a*, 1*b*, 1*c*.

Nookneamish River, north-west end of Vancouver Island, G. M. Dawson, 1885: six badly preserved, but nearly perfect, and eight imperfect casts of the interior of the shell. These specimens are very variable in shape, no two being alike.

CEPHALOPODA.

PLACENTICERAS OCCIDENTALE, Whiteaves.

Plate 21, fig. 1.

Placenticeras occidentale, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N.S., vol. II, for 1886, page 113 B.

Shell strongly compressed at the sides, periphery rather sharply angulated but not distinctly keeled; outer whorl very closely embracing, umbilicus rather narrow, a little less than one fourth of the greatest diameter, aperture narrowly sagittate, its base deeply emarginate by the encroachment of the preceding volution.

Surface of the sides of the outer whorl marked by broad and rather distant, radiating, bifurcating and doubly flexuous raised plications, which commence at the umbilical margin, curve at first gently forward, then as gently backward, and are finally bent very abruptly forward next to the periphery, upon which they form narrow, elongated and acute tongue-like processes. In addition to these plications the surface is marked by fine, simple and comparatively close set, radiating, raised lines, which are also doubly flexuous on each side. These raised lines are most strongly marked on the outer half of the sides, and are as well defined on the summits of the plications as in the smaller spaces between them. Septation unknown.

K-uk River, coast of British Columbia, G. M. Dawson, 1885: one tolerably well preserved but somewhat imperfect cast of the interior of the shell, whose greatest diameter is a little less than five inches.

This species seems to be most nearly related to the *Ammonites bicurvatus* of Michelin, from the Gault of France, as figured by d'Orbigny on Plate 64, figs. 3 and 4 (but not figs. 1 and 2 of the same plate, which, according to Pictet, represent *A. Cleon*, d'Orb.) of the Atlas to the first volume of the Paléontologie Française, Terrains Crétacés. It seems, however, to differ from *A. bicurvatus*, which Zittel places in Meek's genus *Placenticeras*, not only in its much greater size, but also in the presence of numerous, closely arranged and doubly flexuous raised lines, in addition to the doubly flexuous radiating plications or rib-like folds which are common to both.

PLACENTICERAS PEREZIANUM.

Ammonites Perezianus, Whiteaves. 1876. Geol. Surv. Can., Mesoz. Foss., vol. I., p. 19, pl. II., figs. 1 and 1 a.
Haploceras Perezianum, Whiteaves. 1884. Ib., p. 204.

Liard River, below Old Fort Halkett, in latitude 59° 26′ and longitude 124° 48′ W., R. G. McConnell, 1887: two specimens, which though a little larger, seem to be precisely similar in all other respects to the type of *A. Perezianus* from the Queen Charlotte Islands. In one of the specimens from the Liard River nearly the whole of the sutural line is well preserved, but the exact shape of the siphonal saddle cannot be ascertained, though it was evidently very small. The first, second, third and fourth lateral saddles, which diminish gradually in size towards the umbilicus, are variously but unequally branched and incised, and are succeeded in the umbilical region by four or five small unbranched saddles with incised margins. The siphonal lobe is moderately large and is divided at the summit into two equal parts by the small siphonal saddle. The first lateral lobe is much larger than any of the rest and is rather deeply and unequally divided a little on one side of the centre by a small offset of the first lateral saddle. All the lobes are incised at their margins, but the siphonal and first lateral lobes are the only ones that are branched.

In 1876, the writer, who had not then seen a copy of Dr. Neumayr's paper on the Ammonites of the Chalk Formation,* expressed the opinion that the type of the present species belongs to the group of the Clypeiformes and that it might prove to be an *Oppelia* allied to the *O. Waageni* of Zittel.

A subsequent study of other specimens from the Queen Charlotte Islands, in 1884, induced the writer to refer the species to *Haploceras*, on account of its supposed affinities with the *Ammonites Cleon* of d'Orbigny and *A. bicurvatus* of Michelin, both of which were placed by Dr. Neumayr in that genus. But, in his Manuel de Conchyliologie, published at intervals between 1880 and 1887, Dr. Paul Fischer states that the genus *Haploceras*, which he regards as a synonym of *Lissoceras*, Bayle, corresponds to the group Ligati, and places the whole of the Clypeiformes in Meek's genus *Sphenodiscus*.

In the second volume of the "Handbuch der Palæontologie" (1881-85), Zittel re-defines and slightly extends the characters of Meek's genus *Placenticeras* so as to make it embrace the whole of the Clypeiformes and among the representative species cites the *Ammonites bicurvatus* of the "Terrains Cretacés," which, Pictet says, includes *A. Cleon*. He (Zittel) restricts the use of the generic term *Haploceras* so as to make it include a few Jurassic and two Neocomian species, and constitutes a new genus, which he calls *Desmoceras*, for the reception of the Ligati.

The present species, no doubt, bears a very close resemblance to *Desmoceras Beudanti* in the general shape of its shell, and in its sutural line, but differs therefrom in the total absence of the distant, periodic arrests of growth which are generally held to be characteristic of the Ligati. Hence it would seem that the former species can no longer be satisfactorily referred to *Haploceras*, or even to *Desmoceras*, but that it belongs to an aberrant section of the Clypeiformes, in which the periphery or abdominal region is more or less narrowly rounded rather than thin and sharp.

By Dr. Fischer the Clypeiformes, as a whole, are included in *Sphenodiscus* and by Zittel in *Placenticeras*. But, if the specimens of the present species collected by Messrs. Richardson and McConnell be carefully compared with Meek's original diagnosis of these two genera, it will be found that they differ materially from *Sphenodiscus* in having their outer lateral lobes and saddles distinctly branched, as well as in the much greater obtuseness of their periphery, and from *Placenticeras* proper, in the circumstance that their narrowly rounded periphery is neither truncated nor "provided with a row of compressed alternating nodes around each margin." Still, under all the circumstances of the case, the course that seems open to the fewest objections is to follow Zittel and to refer the species, for the present at least, to *Placenticeras*.

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*Über Kreideammonitiden. Aus dem LXXI Bande der Sitzb. der K. Akad. der Wissensch., 1 Abth. Mai-Heft, Jahrg. 1875.

PLACENTICERAS (PEREZIANUM? var.) LIARDENSE.

Plate 20, figs. 1 and 2.

Liard River, near Old Fort Halkett, R. G. McConnell, 1887: four other specimens of an Ammonite, which may possibly represent a local variety of *P. Perezianum*. They were found in flattened lenticular masses which have been split open in such a way as to expose one side only of each shell, and two out of the four are mere fragments. The characters of the periphery cannot be ascertained in either, the sides are crushed nearly flat and the sutural line is not visible, but the surface markings and the size and shape of the umbilicus are clearly shown in all.

So far as it can be made out, the general contour of each of these four specimens appears to have been essentially the same as that of the type of the species, but their sculpture is of a much more decided character, and consists of well defined, slightly flexuous, rounded and transverse, rib-like folds, which widen rapidly outward towards the periphery and are entirely devoid of tubercles. At an early stage of growth these folds are simple, and alternately long and short, but in the larger specimens, most of the longer folds bifurcate near the middle of the sides, and a shorter fold, which becomes obsolete before reaching the umbilical margin, is usually intercalated between each pair of the longer ones.

SCAPHITES QUATSINOENSIS.

Plate 21, fig. 2.

Olcostephanus Quatsinoensis, Whiteaves. 1882. Trans. Roy. Soc. Can., vol. I., Section IV., p. 82, woodcut fig. 1.
Scaphites Quatsinoensis, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. S., vol. II., p. 114 B.

East side of Winter Harbour, Forward Inlet, Quatsino Sound, Vancouver Island, G. M. Dawson, 1885 : two well preserved and nearly perfect but not quite adult specimens and a few fragments.

These show clearly that the species is not an *Olcostephanus* of the type of *O. bidichotomus*, as was at first supposed, but a finely-ribbed small Scaphite, very nearly related to the *Scaphites æqualis* of Sowerby. Its ribs too are not invariably bidichotomous, for in some of the specimens collected in 1885 they trifurcate, while in others, in closely contiguous portions of the same specimen, they are bidichotomous, trifurcate, or simple with shorter ones intercalated between, though they are apparently never tuberculated nor nodose.

The type of *O. Quatsinoensis* is a well preserved but very imperfect and immature specimen collected by Dr. Dawson in 1878 at Browning Creek, Forward Inlet, where it is associated with an abundance of *Aucella Mosquensis*, var. *concentrica*.

B. FROM THE NORTH WEST TERRITORY.

(1.) FROM RINK RAPIDS, ON THE LEWES RIVER, A TRIBUTARY OF THE YUKON, IN LATITUDE 60° 20′ AND LONGITUDE 136° 30′; COLLECTED BY DR. G. M. DAWSON IN 1887.

BRACHIOPODA.

DISCINA PILEOLUS. (N. Sp.)

Plate 21, figs. 3 and 3 a.

Upper or dorsal valve (the only one known) depressed conical, its greatest height being a little less than one half of its maximum breadth: apex erect and placed a little behind the mid-length: base broadly elliptical or elliptic ovate in outline, and about one fourth longer than broad.

Surface shining, polished and marked with crowded and minute but somewhat irregularly disposed concentric raised lines.

Length of the most perfect specimen collected, twelve millimetres; breadth of the same, a little more than nine mm. and a half: approximate height, four mm.

Two dorsal valves, one of which is nearly perfect and remarkably well preserved.

LAMELLIBRANCHIATA.

CYPRINA YUKONENSIS. (N. Sp.)

Plate 21, fig. 4.

Shell rather small, compressed convex, inequilateral: marginal outline varying from subcircular or ovately subcircular to subovate, the height in the majority of specimens being very nearly as great as the length. Anterior side short and rounded: posterior side longer and somewhat obliquely subtruncated at its extremity: ventral margin longitudinally semiovate, rounding upward rapidly in front and straighter behind: superior border sloping downward very gently behind the beaks and descending abruptly and concavely in front of them: beaks broad, prominent, appressed, placed in advance of the mid-length, and curved obliquely forward: posterior umbonal slopes sometimes distinctly angulated, but, as this character is seen in only one specimen, it may be the result of distortion.

Surface marked by concentric lines of growth. Hinge dentition and muscular impressions unknown, though the pallial line appears to have been entire.

Dimensions of one of the most perfect specimens collected: maximum length, thirteen millimetres; greatest height, twelve mm.

One somewhat crushed left valve, with the whole of the test preserved, two perfect and well preserved casts of the interior of the same valve and three similar casts of the right valve.

This species is rather variable in shape, and seems to be most nearly allied to the *Cyprina Marcousana* of[*] de Loriol, from the Middle Neocomian of Switzerland.

CEPHALOPODA.

SCHLOENBACHIA BOREALIS. (N. Sp ?)

Plate 21, fig. 5.

Perhaps a variety of *Schloenbachia propinqua.*

Cfr. *Schloenbachia propinqua,* Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 247, pl. 33, figs. 2, 2a, 2b, 2c.

Shell compressed at the sides, its periphery encircled by a flattened, thin and very prominent simple keel, which attains to a height of three millimetres near the aperture: umbilicus wide and shallow. Volutions about five in number, increasing rather rapidly in size, but more rapidly in a dorso-ventral than in a lateral direction, not very closely embracing, nearly the whole of the sides of the inner ones being exposed: umbilicus, as measured from suture to suture, occupying about one-third of the entire diameter, and nearly equal in width to the height of the aperture just outside of its emargination. Aperture narrowly subelliptical, higher than broad, pointed above and very shallowly emarginated below by the slight encroachment of the preceding volution.

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[*] See Pictet and Campiche's Paléont. Suisse., Foss. du Terr. Cret. des Envir. de Ste. Croix, Ser. 3, p. 214, pl. 113, figs. 3 and 4.

On the outer volution, each of the sides is ornamented by doubly flexuous, transverse and rib-like raised plications, which are interrupted by or do not pass over the prominent keel on the periphery, and which are entirely devoid of tubercles. Most of these plications extend completely across the sides, and some of them bifurcate or even trifurcate at about their mid-length, but near the keel a short fold is occasionally intercalated between two of the longer plications.

The characters of the sutural line are not satisfactorily exhibited in any of the specimens collected. In a small cast of the interior of the shell, whose longest diameter is about three-quarters of an inch, three lobes and as many saddles can, it is true, be counted on one side of the siphonal saddle, but the whole of the exposed surface of this cast is so much worn that nearly all the finer incisions and ramifications of the sutures are obliterated.

Dimensions of the largest and most perfect specimen obtained; greatest diameter sixty-two millimetres: width of umbilicus, as measured from suture to suture, twenty-three mm.: height of aperture, inclusive of keel, twenty-two mm.

In addition to the specimen whose dimensions have just been given, six much smaller examples, and several impressions or fragments of others, were collected.

This shell is certainly very closely related to the *Schloenbachia propinqua*, from the "Lower Sandstones or Division E" of the Cretaceous rocks of the Queen Charlotte Islands, and may prove to be only a local variety of that species. Judging by the rather scanty material at present available for comparison, the present form appears to differ from the typical *S. propinqua* in having more slender whorls (in a dorso-ventral direction) and a consequently wider umbilicus,—in its more distinctly doubly flexuous folds, and in the greater prominence of its abdominal keel. *S. borealis* seems also to be very nearly allied to the *Schloenbachia cultrata* (the *Ammonites cultratus* of d'Orbigny) of the French Neocomian, and to differ therefrom in almost exactly the same way as it does from *S. propinqua.*

The *Aptychus* or portion of an *Aptychus* represented on Plate 21, (fig. 6) was found in the same beds as the *S. borealis*, and may have belonged to that species. It is longitudinally semiovate in outline, and its outer surface is marked only with rather closely disposed concentric raised lines.

CRUSTACEA.

PHYLLOPODA.

Estheria bellula. (N. Sp.)

(Plate 21, figs. 7 and 7a.)

Carapace valves compressed at the sides, but regularly though moderately convex (so that a transverse section of both when closed would be ovately and narrowly lenticular in outline), inequilateral, a little longer than high and varying in outline in different specimens from obliquely subovate to longitudinally semiovate. Anterior end always shorter and generally narrower than the posterior.

The most perfect specimen collected, which is figured on Plate 21, fig. 7, and which may be regarded as the type of the species, is obliquely subovate in marginal outline. Its anterior and posterior ends are both rounded, as are also both of its cardinal angles, and its dorsal margin is comparatively short, though more than half the entire length. In one of the longitudinally semiovate examples (fig. 7 A) the anterior end is angular at its junction with the dorsal margin above, and much narrower than the posterior end, which latter is rounded both above and below; while in another, the marginal outline is not far from semicircular, the dorsal border or hinge line extends nearly the whole length of the valves, and is angular at both ends. Umbones small, depressed, contiguous and placed near the anterior end, but not quite terminal.

Surface marked by from thirteen to eighteen closely and rather regularly disposed concentric ridges, which are rounded and not very prominent, although distinctly defined.

Dimensions of one of the most perfect specimens collected: maximum length, seven millimetres: greatest height, five.

One perfect and well preserved cast of the interior of a pair of valves which had become widely spread out, a few similar but not quite so well preserved casts of detached valves, and a single cast of the exterior of a left valve.

As no portion of the thin test is preserved on any of these specimens, it is of course by no means certain that they are really the valves of phyllopod crustaceans. Still, in spite of the circumstance that the other organisms with which they are associated seem to indicate purely marine rather than fresh water or brackish conditions, these little fossils appear to the writer to bear a much closer resemblance to some of the species described and figured by Professor T. Rupert Jones in his "Monograph on the Fossil Estheriæ," published by the Palæontographical Society, than they do to any lamellibranchiate bivalve.

The few fossils collected by Dr. Dawson at this particular locality on the Lewes River are, perhaps, not altogether sufficient to indicate the exact position which the rocks from which they were collected occupy in the Cretaceous System. The genera *Discina* and *Estheria* have such an extensive range in time that they afford no definite information on this point. The most characteristic fossil, apparently, which has yet been found in these rocks, is the *Schloenbachia* which has just been described under the name *S. borealis*. This species appears to be very nearly related to the *S. propinqua* of the lowest division yet recognized of the Cretaceous rocks in the Queen Charlotte Islands. As will be seen farther on, it occurs also in the Rocky Mountains near Devil's Lake, in deposits which hold several other species of fossils which were first described from specimens collected in the Lower Shales and Sandstones, or Subdivision C of the Queen Charlotte Island Cretaceous. So far as it goes, therefore, the palæontological evidence would seem to show that these rocks on the Lewes River represent as low a horizon in the Cretaceous system as has yet been definitely recognized in Canada.

(2.) FROM THE ROCKY MOUNTAINS THREE MILES NORTH OF THE EAST END OF DEVIL'S LAKE; COLLECTED BY R. G. MCCONNELL IN 1887.

J[illegible]
See : [illegible]
[illegible]

Probably from the same geological horizon as the Lower Shales and Sandstones of the Queen Charlotte Island Cretaceous.

BRACHIOPODA.

TEREBRATULA ROBUSTA. (N. Sp.)

Plate 22, figs. 1, 1 a, 1 b and 2.

Shell large, rather strongly convex, the maximum thickness through the closed valves being very little less than their greatest breadth marginal outline ovately subelliptical, the length being nearly one third greater than the breadth, and the greatest breadth a little in advance of the midlength; front margin subtruncated in the centre; posterior extremity bluntly pointed.

Ventral valve rather more convex than the dorsal; the umbo of the former moderately prominent, its beak incurved and slightly decurved as well as somewhat obliquely truncated; deltidium very small as the central portion of the anterior margin of the truncated beak of the ventral valve almost touches the beak of the dorsal; foramen rather large and apparently complete. In an end view the front margin of the ventral valve is seen to be sinuated, the sinus being very shallow and indistinctly defined, but moderately broad and nearly straight in the centre. At a short distance from the front margin the mesial fold and sinus become obsolete.

Dorsal valve smaller as well as less convex than the ventral, its beak small and depressed, and its front margin provided with a shallow mesial fold which fits into the corresponding sinus of the opposite valve.

The foregoing description is applicable only to the adult shell. In immature specimens the marginal outline is very nearly circular, the length and breadth are almost equal, and the shallow fold and sinus of the front margin of the valves are not developed.

The surface markings are very imperfectly preserved, but the exterior appears to have been nearly smooth, and marked only by concentric lines of growth and by minute and crowded radiating striæ.

The markings on the interior of the valves are also very imperfectly preserved. In a cast of a dorsal valve there is a longitudinal median groove less than half the entire length, which probably represents the septum. In the same cast the posterior adductor appears to have been long, narrow, pointed at both ends, and more convex on its inner margin than externally, while the anterior adductor, though also long, narrow and pointed posteriorly, is narrowly rounded and somewhat dilated in front.

Dimensions of an average adult specimen: maximum length, seventy-one millimetres; greatest breadth, forty-eight mm. and a half; thickness through the closed valves, forty-two mm.

Seventen more or less perfect casts of the interior of the closed valves were collected, some of which have portions of the test adherent thereto.

Two specimens of a *Terebratula* collected by Mr. James Richardson in 1872 from the "Lower Shales and Sandstones" of Skidegate Inlet in the Queen Charlotte Islands, appear to be immature individuals of this species.

OSTREA SKIDEGATENSIS, Whiteaves.

Ostrea Skidegatensis, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mes. Foss., vol. 1 p. 243, fig. 12.

Two casts of the interior of the shell of an *Ostrea* which is probably referable to this species.

EXOGYRA. Species undeterminable.

Four casts of what appear to be the convex valves of a small mytiloid or subtriangular and somewhat arcuate *Exogyra*, which the writer has not been able to identify with any known species but which are not in a satisfactory condition for description or illustration.

LIMA PEROBLIQUA. (N. Sp.)

Plate 22, figs. 3 and 3 a.

Shell of medium size, strongly compressed, very inequilateral and broader than long; marginal outline obliquely semioval. Anterior side or buccal region nearly straight, but very slightly concave in the middle, its margins being deeply but narrowly inflected; posterior side or anal region broadly rounded, but truncated or subtruncated in the cardinal region; pallial border narrowly rounded. Beaks moderately prominent, anterior, terminal, the posterior umbonal slope forming nearly a right angle with the anterior. Ears and cardinal area unknown. The only portion of the test that happens to be preserved in either of the two specimens collected, is a small piece round the anal margin of the less perfect of the two. On this part of the shell the surface ornamentation appears to consist of very fine and delicate radiating striæ or impressed lines, which are much narrower than the flattened spaces between them, and of concentric lines of growth.

Dimensions of the most perfect specimen collected : greatest length, forty-one millimetres; maximum breadth of the same, fifty-seven mm. A not very well preserved but nearly perfect cast of the interior of a left valve and a portion of another.

Although its surface markings are very imperfectly exhibited, the lateral outline of this shell seems to be very different to that of any other species of *Lima* that has so far been described and figured as occurring in the Cretaceous rocks of North America.

PTERIA (OXYTOMA) CORNEUILIANA, d'Orbigny.

Plate 23, figs. 1, 1 a and 1 b.

Avicula Corneuiliana, d'Orbigny, 1845. Pal. Franc., Terr. Cret, tome III, p. 471, pl. 389, figs. 3 and 4.
" " Pictet and Campiche. 1868–71. Paléont. Suisse., Descr. des foss. du Terr. Cret. des Env. de Ste. Croix, tome III, p. 66, pl. 152, figs. 1–4.

A few detached and more or less imperfect valves of a shell which cannot at present be satisfactorily distinguished from the above named European species. The following is a description of the specimens collected by Mr. McConnell, as they appear to the writer.

Shell rather large, very inequilateral: left valve compressed but somewhat tumid in the umbonal region, at least in some specimens; right valve nearly flat; marginal outline of the valves, apart from the two wings, obliquely and broadly semiovate, the maximum length very slightly exceeding the greatest height. Anterior side very short and broadly rounded; posterior side produced and much longer, as well as more narrowly rounded at its termination, than the anterior; pallial border convex; hinge line apparently straight both behind and in front of the beaks; anterior wing small and triangular; posterior wing apparently short and extending to less than half the distance from the beak to the farthest termination of the valve behind (at least in the most perfect left valve collected) but much longer proportionately in the most perfect right valve, its posterior margin concavely excavated; beaks small, scarcely projecting above the highest level of the hinge line, and placed considerably in advance of the midlength.

The surface markings of the largest and most perfect of the left valves collected consist of seventeen narrow but prominent, distant and simple radiating ribs, and these are separated from each other by broad flattened spaces which bear still narrower and much less prominent radiating raised lines. The principal ribs seem to have projected beyond the outer margin of the valve as short free spines, and between each pair, on and around the said margin, from five to six radiating raised lines can be counted.

The right valve is marked only by numerous fine radiating ribs, which are much smaller than the large ones in the opposite valve, as well as nearly equal in size and placed comparatively close together.

Hinge dentition and muscular impressions of both valves unknown.

Maximum length of the largest specimen collected (a left valve) sixty-eight millimetres; greatest height of the same sixty-one mm.

Two well preserved moulds of the exterior of the left valve, one nearly perfect and both shewing the surface markings well; three casts of the interior of the same valve, and three imperfect right valves.

It is not improbable that specimens of an *Oxytoma* from Subdivisions C. and E. of the Cretaceous rocks of the Queen Charlotte Islands, which the writer referred to the *O. mucronata* of Meek and Hayden (on pages 238 and 251 of the first volume of Canadian "Mesozoic Fossils") may prove to be immature individuals of the present species.

INOCERAMUS.

Three casts of the interior of detached valves of shells which obviously belong to this genus, but which are far too imperfect and too badly preserved to be determined specifically. They seem, however, to represent two species, both of which are referable to the section or subgenus *Catillus* of Brongniart, in which the hinge line is elongated in a direction parallel with the longer axis of the shell.

TRIGONOARCA TUMIDA, Whiteaves.

Trigonoarca tumida, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 235, pl. 31, fig. 6.

One imperfect and and badly preserved cast of the interior of both valves, and three similar casts of detached left valves, which resemble the type of this species very closely in external form, but which are in too bad condition to be identified with much certainty.

TRIGONIA DAWSONI, Whiteaves.

Trigonia Dawsoni, Whiteaves. 1878. Geol. Surv. Can., Rep. Prog. 1876-77, p. 154. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 231, pl. 31, figs. 1 and 1a.

A few specimens, which are evidently conspecific with the original types of *T. Dawsoni* from the Iltasyouco River and Sigutlat Lake.

In 1884 the writer expressed the opinion that the shells for which this name had been suggested were probably identical with the *Trigonia intermedia* of Fahrenkohl, from the Neocomian of Russia. About a year after this statement was made, however, three unusually large, perfect and well preserved specimens of *T. Dawsoni* from Skidegate Inlet, in the Queen Charlotte Islands, were presented to the Museum of the Survey by Mr. James Deans, of Victoria, V. I. A comparison of these specimens with Eichwald's description and figures of *T. intermedia* has not tended to confirm the impression that *T. Dawsoni* is synonymous with that species, but has led to the conclusion that there are apparently several points of difference between them, which may be thus briefly summarized.

1. *T. Dawsoni* seems to have attained to fully twice the size of *T. intermedia*. According to Eichwald the latter measures one inch and a half in length, from the anterior to the posterior side, and one inch in height, measured from the middle of the inferior margin to that of the dorsal border, whereas the corresponding dimensions in the largest of the three specimens of *T. Dawsoni* from Skidegate Channel are, length three inches and an eighth, height two inches.

2. The curved ribs of *T. intermedia* are said to be ornamented with very small *spinous* nodes, but in *T. Dawsoni* the nodes on the ribs can scarcely be called very small, and they are generally obtusely rounded, though often intersected or partly intersected by the concentric grooves which alternate with the rather crowded raised lines of growth.

3. There appears to be a slight but constant difference between the sculpture of the broad posterior area of *T. Dawsoni* and that of *T. intermedia.* In the last named species this area is described as over-run (parcourue) with oblique, almost vertical, close striæ, divided into two parts by a horizontal groove. In the figures of *T. intermedia* these vertical striæ are represented as straight, parallel, regular, continuous and devoid of tubercles, and the only tubercles on the posterior area appear to be those on the elevated ridge which separates it from the main body of the shell. But, in *T. Dawsoni* the vertical raised lines on the posterior area are often irregularly disposed, interrupted, more or less angularly bent as well as somewhat tuberculated, and there are indications of a row of transversely elongated tubercles on each side of the central groove, and of a similar but less distinct row on the subangular ridge which separates this area from the escutcheon proper.

In view of these apparent differences between the two forms, it is probably advisable to retain the name originally given to the types from British Columbia, for the specimens from that province and for those now under consideration from the Rocky Mountains.

ASTARTE CARLOTTENSIS, Whiteaves.

(For the synonymy of this species and reference to the publication in which it was figured, see page 154 of this Report.)

One fairly characteristic specimen of a left valve.

PROTOCARDIUM HILLANUM, (?) Var.

Cardium Hillanum, Sowerby. 1813. Min. Conch., vol. I., p. 41, pl. 14, fig. 1.
" " d'Orbigny (as of Sby.) Pal. Franc., Terr. Cret., vol. iii., p. 27, pl. 243.
Protocardium Hillanum, Stoliczka. 1871. Palœont. Indica. Cret. Faun. S. India, vol. iii, p. 219, pl. 12, figs. 8-10 and pl. 13, figs. 1-3.
" " Whiteaves.—1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. 1, p. 228, pl. 30, fig. 5.

Three casts of the interior of single valves and a similar cast of a pair of partially displaced valves of a rather large species of *Protocardium*, which seems to differ from *P. Hillanum* only in being rather more produced behind and consequently a little longer than high. The maximum length of the largest specimen collected at this locality is thirty-nine millimetres and its greatest height, inclusive of the beaks, thirty-four mm., or as measured in the centre, just behind the beaks, thirty mm. The impressions left by the radiating ribs on the posterior area are plainly visible on these casts, but no traces of any concentric markings can be detected on the remainder of their surface. In d'Orbigny's figures of a cast of a French specimen of *C. Hillanum* the maximum length and height are represented as exactly equal, but the small specimens from the Queen Charlotte Islands which the present writer has identified with that species, like those from the Rocky Mountains now under consideration, are a little longer than high.

CYPRINA OCCIDENTALIS, Whiteaves.

Cyprina occidentalis, Whiteaves.—1884. Geol. and Nat. His. Surv. Can., Mesoz. Foss., vol. 1, p. 227, woodcut, fig. 10.

One small but nearly perfect cast of the interior of both valves and a less perfect but in other respects similar cast of a left valve, both of which can be somewhat confidently identified with this species, which is neariy related to the *C. Dallii* of White,* from the Cretaceous rocks of Alaska.

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* Bull. U. S. Geol. Surv., Washington, 1884, p. 14, pl. vi., fig. 1.

PLEUROMYA CARLOTTENSIS, Whiteaves.

Pleuromya Carlottensis, Whiteaves. 1876. Geol. and Nat. His. Can., Mesoz. Foss. vol. I, p. 57, pl. 9, fig. 8.
Pleuromya subcompressa, var. Carlottensis, Whiteaves. 1884. Ib., p. 223, pl. 29, figs. 7 and 7a.

One imperfect but fairly characteristic specimen. It is quite possible that the shells for which this name was proposed, are only a local variety of the *Pleuromya papyracea* of Gabb,* from the Shasta Group of California, and that the *Pholadomya Vancouverensis*† which was described and figured by the present writer from a single specimen collected by Dr. G. M. Dawson in 1877 from the north-east slope of Jackass Mountain, in the valley of the Lower Fraser River, is, as already stated on page 153, either another variety of the same species, or the same shell in an unusual and very peculiar state of preservation.

CEPHALOPODA.

SCHLOENBACHIA BOREALIS, Whiteaves.

(This species has already been described on page 160 of this Report and is figured on Plate 21.)

Two specimens, which do not seem to differ in any essential particular from the type of *S. borealis* from the Lewes River. One is a badly preserved cast of the interior of a shell, and the other a well preserved mould of the exterior of another,‡ both of which measure about three inches and a half in their greatest diameter.

A third specimen, which is probably only a variety of the same species, was also collected by Mr. McConnell at this locality. It resembles the type of *S. borealis*, both in external form and in the prominence of its simple abdominal keel, but has much coarser ribs, many of which bifurcate half way across the sides.

The occurrence of the same species of Ammonite at localities so wide apart as the Rink Rapids of the Lewes River and the Rocky Mountains near Devils Lake, is not without significance from a purely geological point of view.

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* Geol. Surv. Calif., Palæont. vol. II, (1869) p. 178, pl. 29, fig. 66.

† Trans. Royal Soc. Can., 1882, vol. I, Sec. IV, p. 83, woodcut, fig. 2.

‡ A very similar specimen to this was collected by Mr. McConnell in the same year at a locality about five miles from that indicated in the last heading, viz., in the Rocky Mountains, three miles north of Devil's Lake and three miles north of the Cascade Trough.

SCHLOENBACHIA GRACILIS. (N. Sp.)

New [illegible] [illegible] Scamma. [illegible], Roy Soc Can., Proc. [illegible] [illegible], 19

Plate 23, figs. 2 and 2a.

Shell shallowly but widely umbilicated, the inner whorls occupying a little more than one half of the entire diameter: periphery encircled apparently with a central and very slightly raised, simple abdominal keel. Volutions about five, narrow, increasing slowly in size and but slightly embracing. Outer volution somewhat rectangular, its sides being compressed and its abdominal region slightly flattened on both sides next to the keel, though rounded off exteriorly. Aperture subelliptical but somewhat rectangular, higher than wide and very slightly emarginate by the encroachment of the preceding volution.

Surface marked by distant, slightly curved, prominent and simple radiating ribs or rib-like folds. On the outer volution these ribs, which curve somewhat obliquely forward in a shallowly concave curve, become obsolete in the abdominal region and disappear before reaching the keel. They are much narrower than the broad, shallow depressions between them, and are most prominent a little more than half way across the sides, where each rib rises gradually into a low, pointed tubercle. Sutural line unknown.

Approximate dimensions of the most perfect specimen collected: greatest diameter, one hundred and ten millimetres; width of umbilicus, from suture to suture, fifty-eight mm.; height of the aperture (at the broken anterior extremity, thirty mm.; width of the same, if measured on the summits of two opposite ribs, twenty-two mm., or, if in the interstices between them, eighteen mm.

Two imperfect and not very well preserved specimens, both of which are mere casts of the interior of the shell.

Associated with these, two other fragments of a *Schloenbachia* were collected by Mr. McConnell, in one of which the abdominal region is encircled by three prominent angular ridges, of which the central one is much the highest, just as in the *Ammonites Tehamaensis* of Gabb,* which would now be called a *Schloenbachia*. In several other respects, however, these fragments differ materially from the types of *S. gracilis* and from *S. Tehamaensis*. Their volutions are much more closely embracing, their outer volution is much broader in a dorso-ventral direction, and their umbilicus is much narrower in proportion to the size of the shell. The ribs on their outer volution, too, are very faint and indistinct, and in none can any trace of a tubercle be detached either near their centre or at their outer termination.

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* Geol. Surv. Calif., Palæont. Vol. II [1869) p. 132.

BELEMNITES. (Species undeterminable.)

Two portions of the phragmocone and five fragments of the guard, the latter all broken at both ends, of a species of Belemnite which it is, of course, quite impossible to identify from such imperfect specimens. One of the fragments of the guard has a deep median groove, which is not the case with any of the others.

(3.) FROM THE PEACE RIVER, A FEW MILES BELOW FORT VERMILION; COLLECTED BY MR. W. OGILVIE, D.L.S., IN 1885.

CEPHALOPODA.

PLACENTICERAS GLABRUM. (N. Sp.)

Plate 24, figs. 1, 1 a and 1 b.

Shell rather strongly compressed at the sides, its maximum breadth being a little more than one fourth of the greatest diameter, most prominent and broadest at the umbilical margin and narrowing very slowly from thence to the periphery, which latter is narrowly but regularly rounded. Umbilicus rather deep and occupying about one-fifth of the entire diameter, though its outer margin is rounded and indistinctly defined. Volutions deeply embracing, fully three fourths or more of the inner ones being covered: suture distinct. Aperture obtusely and narrowly subsagittate, its outline, outside of the deep basal emargination, being narrowly elliptic ovate. Length of body chamber unknown.

Surface apparently smooth, though not a vestige of the outer layer of the test is preserved.

The sutural line, which is minutely and angularly incised throughout its entire length, is composed of two large outer lateral saddles and five much smaller inner ones, as well as one large outer lateral lobe and four much smaller inner ones (or seven of the latter, if three very small ones on the lower part of the umbilical wall be counted) on each side of the siphonal saddle and lobe. The small siphonal saddle is angularly notched on each side of the centre and divided into three erect spurs, the middle one of which is the shortest and the least incised at its margin. The first lateral saddle is much broader than high; it is also broader than the second, but not quite so high. The upper portion of the first lateral saddle is deeply divided near the middle into two nearly equal parts, each of which is subdivided into three spreading branchlets with bifurcate or trifurcate apices. Between the first and second lateral saddles there are two rather small auxiliary saddles, the outermost of which is the larger and the more subdivided of the two. The second lateral saddle is deeply divided near the centre into two unequal parts, the outer one of which bears four short incised branchlets and the inner five. The third lateral saddle is so deeply divided in the middle as to form two almost independent saddles. Of these, the outer one, which is the larger of the two, bears three branchlets at its summit, and the inner one two. The fourth lateral saddle is somewhat similar to the third, but a little smaller. The fifth, sixth and seventh, which are still smaller and decrease gradually in size toward the suture, are rather emarginate than branched at their summits.

The siphonal lobe is about equal in height to the first lateral lobe. On each side the former bears two spreading lateral branches, which trifurcate at their summits, besides a short, erect, incised spur next to the siphuncle above, and a similar but spreading spur or offset at the base. Between the siphonal and first lateral lobes, as also between the first and second, second and third, and third and fourth lateral lobes, there are three small auxiliary lobes, of which the central one is always the largest. The first lateral lobe is broad in its basal and undivided portion, which bears a lateral incised spur or offset on each side. Its upper moiety is deeply divided into two branches of unequal size, viz., into an outer and smaller one which bifurcates above and an inner or larger one which trifurcates above, while both widen outward and ultimately throw of a number of minute and more or less deeply incised lateral branchlets or spurs. The second lateral lobe is shorter and much narrower than the first. Though its apex is minutely bifid, the lobe itself is not deeply divided above, but it bears on each side three irregularly incised spurs or offsets, which also widen a little outward. The third lateral lobe is much shorter than the second, and its upper portion is divided into two branches which trifurcate on their outer sides. The fourth is smaller, but in other respects similar to the third, and the rest of the lobes, which are not branched but incised at their margins, are very small, and decrease gradually and regularly in size to the suture.

Dimensions of the only specimen collected: greatest diameter, ninety six millimetres; maximum breadth, twenty-six mm.; greatest width of the umbilicus, nineteen mm.

One remarkably well preserved and nearly perfect cast of the interior of the septate portion of the shell, which shews the finest details of the lobes and saddles over nearly the whole of its surface, except where they are covered by small portions of the inner layer of the test.

This species appears to belong to the same group of Ammonites as the **A. Cleon* and *A. nisus*† of d'Orbigny and the *Placenticeras Porezianum* of the Queen Charlotte Islands, and the remarks on pages 157 and 158 of this report, on the generic position of the shell last named, are equally applicable to *P. glabrum.*

(4.) FROM THE FORT PIERRE GROUP OF THE LATER CRETACEOUS ROCKS OF THE SASKATCHEWAN AND ITS TRIBUTARIES; COLLECTED BY J. B. TYRRELL IN 1885 AND 1886.‡

LAMELLIBRANCHIATA.

PTERIA LINGUIFORMIS, var. SUBGIBBOSA, Meek.

Avicula subgibbosa, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 180.
Pteria subgibbosa, Meek. 1864. Smithson. Check-List N. Am. Cret. Foss.
Pteria linguiformis, var. *subgibbosa*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 33, pl. 28, fig. 12.

Battle River, Township 46, Range 4, west of the 4th Principal Meridian, 1885.

INOCERAMUS SAGENSIS, var. NEBRASCENSIS, Owen.

Inoceramus Sagensis, Owen. 1852. Geol. Rep. Wisc., Iowa & Minn., p. 582, pl. 7, fig. 3.
Inoceramus Nebrascensis, Owen. 1852. Ib., p. 582, pl. 8, fig. 1.
Inoceramus Sagensis, var. *Nebrascensis*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 52, pl. 13, figs. 2 a, b.
Inoceramus Sagensis, Whitfield. Pal. Black Hills Dakota, p. 393, pl. 7, fig. 12, and pl. 8, fig. 2.

Mouth of Vermilion River, Township 54, Range 3, west of the 4th Principal Meridian; North Saskatchewan River, Township 54, Range 2, west of the 4th Principal Meridian; Nose Creek, Section 24, Township 44, Range 2, west of the 4th Principal Meridian, 1886: one specimen from each of these localities.

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* For the synonymy of this species see Pictet and Campiche, Pal. Suisse, t 1, p. 169.

† Pal. Franc., Terr. Cret., t. 1, p 184, pl. 55, figs. 7-9.

‡ Pages 174 to 184 are reprinted, with some additions, from an Appendix to Mr. Tyrrell's Report in the Annual Report of the Survey for 1886, Vol. 2, New Series, pp. 158-168 E.

INOCERAMUS VANUXEMI, Meek and Hayden.

Inoceramus Vanuxemi, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 180.
Inoceramus Mortoni, Meek and Hayden. 1860. Ib., p. 428.
Inoceramus proximus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 53, pl. 12, fig. 7; and var. *subcircularis*, Meek, ib., p. 55, pl. 12, fig. 2.
Inoceramus Vanuxemi, Whitfield. Pal. Black Hills Dakota, p. 396, pl. 7, figs. 8, 9, and pl. 8, figs. 4, 5.

Mouth of Vermilion River, Township 54, Range 3, west of the 4th Principal Meridian, 1886, five specimens; and North Saskatchewan River, Township 54, Range 2, west of the same meridian, 1886, two specimens.

GERVILLIA RECTA, var. BOREALIS, Whiteaves.

Gervillia recta, var. *borealis*, Whiteaves. 1885. Contr. to Canad. Palæont., vol. I., p. 35, pl. 4, figs. 2, 2 a and 2 b.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: a few characteristic fragments.

TANCREDIA AMERICANA, Meek and Hayden.

Hettangia Americana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 274; and 1860, Ib., vol. XII., p. 185.
Tancredia Americana, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 142, pl. 38, figs. 1, a–h.

Same locality and date as the preceding species: two very imperfect and badly preserved specimens.

CYPRINA OVATA, Meek and Hayden.

Cyprina ovata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 144.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 146, pl. 29, figs. 7 a, b, c, and pl. 30, fig. 11.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, and Township 40, Range 15, west of the same meridian, 1885: a single and barely recognizable specimen from each of these localities.

CYPRINA SUBTRAPEZIFORMIS, Whiteaves.

Plate 24, figs. 2, 2a and 2b.

Cyprina subtrapeziformis, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep. N. Series, vol. II, p. 155 E.

Shell small, inequilateral, transversely subtrapezoidal: valves moderately convex, most prominent on the posterior umbonal slopes, which are subangular: height (in the centre) one third greater than the maximum breadth: length a little more than one fourth greater than the height. Anterior side short and evenly rounded: posterior side about three times as long as the anterior, its extremity obliquely truncated above and somewhat bluntly pointed below: superior border descending rather abruptly in an obliquely convex curve in front of the beaks, and nearly straight and parallel with the ventral margin behind them: umbones swollen laterally, but scarcely prominent: beaks small, appressed and slightly depressed, placed about half-way between the centre and the anterior margin: lunule none: posterior area subangularly inflected, but very indistinctly defined: ventral margin nearly straight for the greater part of its length, but rounding up abruptly at the anterior end and forming an obtusely subangular junction with the posterior margin behind.

Surface marked with rather coarse concentric lines of growth: test somewhat thin. Anterior muscular impression subovate: posterior muscular impression rather larger and more nearly circular: pallial line simple and entire: hinge dentition unknown.

Dimensions of the most perfect specimen collected: maximum length, twenty-three millimetres and a half; greatest height, fifteen mm; approximate thickness through the closed valves, ten mm.

Battle River, Township 46, Range 4, west of the 4th Principal Meridian, 1885: apparently abundant. About thirty specimens were collected at this locality, but of these, only one is quite perfect, with the whole of the test preserved, while the rest are for the most part little more than mere casts of the interior of the closed valves, with portions of the exfoliated test adherent thereto.

The hinge dentition being unknown, it is uncertain to what genus this shell should be referred. It may prove to be a *Cypricardia* or a *Veniella* rather than a *Cyprina*.

PROTOCARDIA SUBQUADRATA, Evans and Shumard.

Cardium subquadratum, Evans and Shumard. 1857. Trans. Ac. Nat. Sc. St. Louis, vol. I., p. 39.

Protocardia (*Leptocardia*) *subquadrata*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 175, pl. 29, figs. 8 a, b, c, d, e.

Protocardia subquadrata, Whiteaves, as of Shumard. 1885. Contr. to Canad. Palæont., vol. I., p. 41, pl. 5, figs. 4 and 4 a.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: a few well preserved and characteristic specimens.

PROTOCARDIA BOREALIS, Whiteaves.

Protocardia borealis, Whiteaves. 1885. Contr. to Canad. Palæont., vol. I., p. 41, pl. 6, figs. 1, 1 a, 2, 2 a, and 3.

"The Nose," Township 27, Range 8, west of the 4th Principal Meridian, 1885: two specimens.

LINEARIA FORMOSA ? Meek and Hayden.

Plate 24, fig. 3.

Tellina formosa, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.

Abra (?) *formosa*, Meek. 1864. Smithson. Check-List N. Am. Cret. Fossils, p. 14.

Linearia (?) *formosa*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 199, pl. 30, fig. 2.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: a perfect right valve of a small Tellinid which corresponds remarkably well with Meek's figure of the above-named species. In the specimen collected by Mr. Tyrrell, however, only the outer surface is exposed to view, the whole of the interior being buried in the matrix. No traces of any radiating striæ can be discovered on its test, with a lens, although the markings on its outer surface are beautifully preserved, and its test does not appear to have been "*very* thin."

PHOLADOMYA SUBVENTRICOSA, Meek and Hayden.

Pholadomya subventricosa, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 142.
Pholadomya subventricosa, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 217, pl. 39, figs. 8, a, b.

North Saskatchewan River, at Fort Pitt, and in Township 54, Range 2, west of the 4th Principal Meridian, 1886: one nearly perfect specimen with both valves preserved, from each of these localities. A portion of a mould of a shell which may have belonged to this species, was collected on the banks of the same river near the mouth of Moose Hill Creek.

Dr. Hector records finding a *Pholadomya* which he refers to *P. occidentalis* of Morton, but which is probably referable to this species, at Fort Pitt, on the North Saskatchewan, and at the elbow of the South Saskatchewan, in 1857 or 1858.

LIOPISTHA UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 81.
Pholadomya (*Cymella*) *undata*, Meek. 1864. Smithson. Check-List N. Am. Cret. Inv. Foss., pp. 14 and 34.
Liopistha (*Cymella*) *undata*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

Nose Creek, Township 37, Range 9, west of the 4th Principal Meridian, 1885: one characteristic specimen.

SOLECURTUS (TAGELUS) OCCIDENTALIS, Whiteaves.

Plate 24, fig. 4.

Solecurtus (*Tagelus*) *occidentalis*, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. Ser., vol. II., p. 157 E.

Shell transversely elongated, a little more than twice as long as high, very nearly equilateral, strongly compressed at the sides, most prominent on the umbonal slopes, and faintly depressed in the middle below. Anterior and posterior ends both rounded at their margins, but rather more broadly so below than above, while the (presumed) posterior extremity is a very little the narrower of the two. Superior border nearly straight for some distance in front of and behind the beaks, which are inconspicuous, central, appressed and depressed; ventral margin nearly straight or very faintly concave in the centre.

Surface apparently marked only with concentric lines of growth. Hinge dentition, muscular impressions and pallial line unknown.

Approximate dimensions of the only specimen collected: maximum height, twenty-three millimetres; greatest length, sixty-seven mm.; thickness through the closed valves, about fourteen mm.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, 1885: an imperfect and badly preserved left (?) valve.

MARTESIA TUMIDIFRONS, Whiteaves.

Plate 25, figs. 1, 1a and 2.

Martesia tumidifrons, Whiteaves. 1887. Op. cit., p. 157 E.

Shell rather large for the genus, very inequilateral, valves subglobose or semiglobose and abruptly swollen in front, produced and rather rapidly attenuated behind; outline, as viewed from above, somewhat pyriform. Greatest height, as measured in the centre, behind the beaks, about equal to the maximum thickness through the closed valves; greatest height, as compared with the maximum length, about as three to five.

Lateral outline transversely subovate; anterior side very short, its outer margin broadly rounded but somewhat truncated inwardly below the middle; posterior side much more elongated, narrowing gradually at its upper margin and much more rapidly from below upward, its narrow and conspicuously gaping extremity being apparently somewhat obliquely truncated, though the margins of the cast of the united valves of the only specimen collected are both a little broken at this point. Superior border rounding abruptly downward in front, and nearly straight, but descending very gently behind: ventral margin broadly rounded, most prominent a little behind the middle: umbones swollen and prominent: beaks large, incurved and depressed, with a slight forward inclination and placed very near the anterior end: escutcheon broadly lanceolate and tolerably well defined.

On the umbonal region of the left valve only, a small portion of the test is preserved, and the outer surface of this is marked with concentric and rather irregularly disposed, ridge-like folds, which are often separated from each other by somewhat broader and rather deep concentric furrows. In addition to these, in each valve an elevated but narrow linear ridge runs obliquely backward from the posterior side of the beaks to a little behind the centre of the ventral margin.

Posterior muscular impression narrowly subelliptical, placed very high up, almost within the escutcheon, and a little behind the mid-length; anterior muscular impression, pallial line and accessory valves unknown. The pedal opening in front seems to have been large and broadly rhomboidal in outline.

The measurements of the only specimen collected are approximately as follows: maximum length, about fifty-one millimetres; greatest height, as measured in the centre, immediately behind the umbones, and maximum thickness through the closed valves, both thirty-one mm.

North Saskatchewan River, Township 54, Range 2, west of the 4th Principal Meridian, 1886: one nearly perfect and well preserved cast of the interior of the closed valves, with a small portion of the test adhering to the left valve. An apparently well characterized and very distinct species.

Since the above description was written, another specimen of this species, the exact locality of which is unfortunately unknown, has been presented to the Museum of the Survey by the Historical and Scientific Society of Manitoba.

In this specimen, which is represented on Plate 25, fig. 2, and which retains a considerable portion of the test, especially on the right valve, the concentric markings would perhaps be better described as raised lines of growth, which are very faint and almost obsolete posteriorly but prominent and well defined anteriorly, rather than as "ridge-like folds." On the tumid anterior portion of each valve these concentric lines of growth are crossed by faint radiating ribs which give to the former a somewhat tuberculated appearance. In this specimen, too, the slightly elevated median ridge which runs obliquely backward from the beak, is longitudinally and very narrowly grooved, at any rate on the right valve.

GASTEROPODA.

HYDATINA PARVULA, Whiteaves.

Plate 24, figs. 5 and 5a.

Hydatina parvula, Whiteaves. 1887. Op. cit., p. 158 E.

Shell small, the outer whorl enveloping all the preceding volutions, strongly inflated and very ventricose, so much so that its maximum breadth is very little less than the entire height or length,—subtruncated posteriorly, broadest above or behind the middle, narrowing rapidly below or in front, and distinctly angular at the base or anterior extremity. Spire narrow, depressed and sunk deeply below the highest level or rounded posterior shoulder of the outer whorl.

Outer lip thin and simple: characters of the aperture and surface markings unknown.

Maximum height or length of the only specimen collected, ten millimetres and a-half; greatest breadth of the same, nine mm.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: one perfect cast of the interior of the shell, with a considerable portion of the inner layer of the test preserved, though the aperture is entirely filled up with the matrix.

This interesting little shell may belong to Conrad's genus *Bullopsis*, rather than to *Hydatina*. It seems to differ from *B. cretacea* of that author in being more expanded posteriorly and more angular in front.

LUNATIA CONCINNA, Hall and Meek. (Sp.)

Natica concinna, Hall and Meek. 1854. Mem. Am. Ac. Arts. and Sc., vol. V., p. 384, pl. 3, figs. 2 a, b, c, d.

Natica Moreauensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, pp. 64 and 282.

Natica (Lunatia) Moreauensis, Meek and Hayden. 1860. Ib., vol. XII., p. 422.

Lunatia concinna, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 314, pl. 32, figs. 11 a, b, c.

Battle River, Township 46, Range 3, west of the 4th Principal Meridian, 1885: four imperfect and badly preserved specimens. Sounding Creek, Township 30, Range 8, west of the same meridian, 1886: one specimen.

CEPHALOPODA.

BACULITES OVATUS, Say.

Baculites ovatus, Say. 1821. Am. Journ. Sc. and Arts, vol. II., p. 41.—Morton. 1829. Journ. Ac. Nat. Sc. Phil., vol. VI., p. 196, pl. 5, figs. 5 and 6; and 1830, Am. Journ. Sc. and Arts, vol. XVIII., p. 249, pl. 1, figs. 6, 7 and 8; also 1834, Synops. Org. Rem. Cret. Group U. S., p. 42, pl. 5, figs. 5 and 6.—Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., vol. V., (N.S.) p. 399, pl. 5, figs. 1, a, b, and pl. 6, figs. 1-7.—Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 394, pl. 20, figs. 2, a, b, d, and 1, a, b.

Ghost River, Township 25, Range 6, west the of 5th Principal Meridian, 1885. North Saskatchewan River, near mouth of Moose Hill Creek; also on the same river, in Township 54, Range 2, and in township 56, range 5, in each case west of the 4th Principal Meridian. Mouth of Vermilion River, in Township 54, Range 3, west of the same Meridian, 1886.

A few specimens from each of these localities, some of which seem to belong to the typical form of the species, while others are apparently intermediate in their characters between *B. ovatus* and *B. compressus.*

BACULITES GRANDIS, Hall and Meek.

Baculites grandis, Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. V., (N. S.) p. 402., pl. 7, figs. 1 and 2, pl. 8, figs. 1 and 2, and pl. 6, fig. 10. Also, Meek, 1876, Rep. U. S. Geol. Surv. Terr., vol. IX., p. 398, fig. 53, and pl. 33, figs. 1, a, b, c.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: two large but fairly characteristic fragments.

BACULITES COMPRESSUS, Say.

Baculites compressus, Say. 1821. Am. Journ. Sc. and Arts, vol. II., p. 41.—Morton. 1834. Synops. Org. Rem. Cret. Group U. S., p. 43, pl. 9, fig. 1; and Journ. Ac. Nat. Sc. Phil., vol. VIII., p, 211.—Hall and Meek. 1854. Mem. Am. Acad. Arts and Sc., Boston, vol. V. (N.S.), p. 400, pl. 5, fig. 2, and pl. 6, figs. 8 and 9.—Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 400, figs. 55 and 56, and pl. 20, figs. 3, a, b, c.

"The Nose," Township 37, Range 8, west of the 4th Principal Meridian, and Nose Creek, Township 37, Range 9, west of the same Meridian, 1885.

North Saskatchewan, near mouth of Moose Hill Creek, apparently grading into *B. ovatus*; same river, in Township 56, Range 5, west of the 4th Principal Meridian; mouth of Vermilion River, in Township 53, Range 3, west of the 4th Principal Meridian: several distorted fragments apparently also passing into *B. ovatus*; North Saskatchewan River, Township 54, Range 2, west of the 4th Meridian, 1886.

SCAPHITES NODOSUS, Owen.

Scaphites (*Ammonites*) *nodosus,* Owen. 1852. Geol. Rep. Surv. Wisc., Iowa and Minn., p. 580, pl. 8, fig. 4.

North Saskatchewan River, near the mouth of Moose Hill Creek, 1886: a fragment of a mould of the exterior of the shell, which shews the characteristic sculpture of the species, but not enough of the general shape to enable one to say to which of the varieties described and figured by Meek (in the ninth volume of the Rep. U. S. Geol. Surv. Terr.) it should be referred.

PLACENTICERAS PLACENTA, Dekay. (Sp.)

Ammonites placenta, Dekay. 1828. Ann. N. York Lyc. Nat. Hist., vol. II, p. 278, pl. 5, fig. 2 (3 by mistake).—Morton. 1829. Journ. Ac. Nat. Sc. Phil., vol. VI, p. 195; and Am. Journ. Sc. and Arts, vol. XVIII, pl. 2, figs. 1, 2 and 3; also 1834, Synops. Org. Rem. Cret. Form. U. S., p. 36, pl. 2, figs. 1 and 2.

Placenticeras placenta, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 465, pl. 24, figs. 2, a, b.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, 1885: a small fragment.

Sounding Creek, Township 30, Range 8, west of the same meridian, 1886; a single but nearly perfect specimen which measures nearly nine inches in its greatest diameter.

CRUSTACEA.

PALÆASTACUS (?) ORNATUS, Whiteaves.

Plate 25, fig. 3.

Palæastacus (?) ornatus, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. Ser., vol. II., p. 161 E.

The foregoing was suggested as a provisional name for a rather remarkable specimen of a long tailed decapod, which evidently belongs to the family *Astacomorpha* of Zittel. Of the Cretaceous representatives of this family, it seems to come nearest to such genera as *Palæastacus* and *Hoploparia*, though it differs from each in some important particulars. In many respects it appears to the writer to be still more nearly related to the recent and fresh-water genera *Astacus* and *Cambarus*, but there is good reason for supposing that it will eventually prove to be the representative of a new generic type, which at present there is not sufficient material to define satisfactorily.

Nearly the whole of the under surface of the cephalothorax of the specimen is buried in the matrix, the front margin of the carapace is very imperfect, the tail fin as well as the under part of the five abdominal segments are broken off, and only small portions of the pinching claws and of the other ambulatory legs are preserved or exposed.

The carapace is moderately convex or slightly depressed, and not quite twice as long as broad. It is divided into two nearly equal parts by a single, well marked and deeply impressed neck furrow, which is arched forward in a shallowly concave curve. Behind this furrow the lateral margins of the carapace are slightly expanded, the test in the branchial region is moderately inflated, and the posterior margin is shallowly concave in the middle. A short distance in advance of the neck furrow, on the outer and lower portion of the carapace, on each side, there is a very short and transverse groove or narrow constriction, which may possibly be confluent with the neck furrow on the strongly decurved lateral margins of this part of the carapace. The exact outline of the anterior margin of the carapace cannot be ascertained, and the tip of the rostrum is broken off. The basal portion which remains is about seven or eight millimetres long. At the base it measures five mm. in breadth, and at the broken anterior extremity its breadth is two mm. Its outer margins are defined by two linear and acute, tuberculated and raised longitudinal ridges, between which the surface is smooth and concavely excavated.

The whole of the outer surface of the carapace is ornamented by rather distant, isolated tubercles. In its posterior moiety these tubercles are somewhat irregularly disposed, though there is a low, very narrow, and rather inconspicuous keel on the median line, on either side of which the cardiac region is comparatively smooth. On the anterior portion of the carapace the tubercles are grouped somewhat obscurely in two or three longitudinal rows on both sides of the narrow median keel, which is continued with greater or less distinctness up to the commencement of the rostrum.

The anterior pinching claws appear to have been unusually short and robust, while their surface is distinctly tuberculated. The portions of the posterior ambulatory legs that happen to be preserved, on the other hand, are very slender, and their surface is minutely granulated. The abdominal segments are badly preserved, but their outer surface seems to have been smooth, though a narrow median keel can be traced throughout the greater part of their dorsal surface.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886.

At the same locality and date, five detached pinching claws of an apparently second species of decapod were collected in as many concretionary nodules. These claws resemble those of *P. ornatus* in the comparative shortness and robustness of their terminal segments, but the outer surface of the latter is finely granulated rather than coarsely tuberculated.

FISHES.

A well preserved tooth of a Selachian was collected on the Battle River, in Township 46, Range 3, west of the 4th Principal Meridian, in 1885; and a pectoral fin, apparently of a large Selachian, at Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, in 1886.

C. FROM MANITOBA*.

FROM THE NIOBRARA-BENTON FORMATION OF THE LATER CRETACEOUS IN THE DUCK AND RIDING MOUNTAIN DISTRICT.

VERMES.

SERPULA SEMICOALITA. (N. Sp.)

Plate 26, fig 1.

Tubes subcylindrical, a little broader than high, attached by their bases to some foreign object, increasing very gradually in size, irregularly curved but apparently never spirally coiled, and growing for the most part in very closely aggregated groups. The tubes often cross each other, and in those places where they either run parallel to or are in contact with each other in the same plane, two, three, four, or more, are not unfrequently united or anchylosed together. Upper surface nearly smooth, marked only by a few irregularly disposed and transverse lines of growth.

Length unknown; average transverse diameter, three millimetres.

Vermilion River, Township 25, Range 20 W.† : two specimens. Swan River, Township 35, Range 29 W.: one specimen. All three from the Niobrara group, or upper part of the series.

MOLLUSCOIDEA.

BRACHIOPODA.

LINGULA SUBSPATULATA (?) Hall & Meek.

Lingula subspatulata, Hall & Meek. 1856. Mem. Am. Ac. Arts & Sciences, Cambridge, vol. V., p. 380, pl. 1, figs. 2 a, b.

Rolling River, Township 35, Range 26 W., J. B. Tyrrell, 1887 : one imperfect valve and a fragment of another, on a small piece of sandstone from the base of the Fort Benton group, or lowest beds of the series.

The more perfect of these two specimens is in almost exactly the same condition as the type of *L. subspatulata*, the shell in both being

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* Mr. Tyrrell, who is at present engaged in making a geological examination of this region, states that although the rocks there seen are precisely similar to those described by Messrs. Meek and Hayden in Nebraska as Nos. 3 and 2 of their typical section, they are so intimately associated together that it is practically impossible to draw any line of demarcation between them.

† All the localities in this district, from which the fossils mentioned were collected, are west of the 1st Principal Meridian.

"preserved only on the margins" and the beak either obliterated or covered by the matrix. In both the lateral margins are nearly straight and parallel and the front border is subtruncate, so that although the type of Hall and Meek's species is said to be from the Fort Pierre group (near Red Cedar Island, on the Upper Missouri River,) and the specimens obtained by Mr. Tyrrell are from a distinctly lower horizon in the Cretaceous, no essential differences can at present be detected between them.

MOLLUSCA.

LAMELLIBRANCHIATA.

OSTREA CONGESTA, Conrad.

Ostrea congesta, Conrad. 1843. Nicollet's Rep. Expl. in the N.W., p. 167.—Hall & Meek (1854) Mem. Am. Acad. Arts & Sc., Boston, vol. VIII. (N. S.), p. 405.—Meek & Hayden (Nov., 1856) Proc. Ac. Nat. Sc. Phil., p. 286.—Hall (1856). Pacific R.R. Repts., vol. III., p. 100, pl. 1, fig. 11.—Meek (1876). Rep. U. S. Geol. Surv. Terr., vol. IX. p. 13, pl. 9, figs. 1 a, f.

Swan River, J. W. Spencer, 1874.

Ochre River, Township 23, Range 17 W., and Township 22 in the same Range; Vermilion River, Township 24, Range 17 W., and Township 25 in the same Range; Rolling River, two miles above the old C.P.R. crossing, and Swan River, Township 35, Range 29 W.; J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W.; D. B. Dowling, 1887.

Assiniboine River, Section 36, Township 8, Range 11 W.; Warren Upham, 1887.

From each of these localities a few specimens, which are apparently referable to this widely distributed species, were collected from the Niobrara group, or upper part of the series. Most of these specimens are less than an inch in their greatest diameter, though they occasionally attain to a length of an inch and a half or an inch and three-quarters. In each of those from Thunder Hill the lower valve is attached to a fragment of a large *Inoceramus*, and the only example in which the shells are clustered is from the Rolling River. All the rest appear to be both single and unattached to any foreign body, though fully one half of the specimens are upper valves. The writer has not yet seen, either from Manitoba or from any other part of Canada, any specimens of *O. congesta* which correspond with that form of the species described and figured by Meek in which the margins of the lower valves are "abruptly deflected upward at right angles to the flat, attached base and produced in this direction often for as much as an inch or more," so that, in certain conditions of preservation these valves look "like short cylindrical tubes with one end abruptly truncated and closed by the flat surface of attachment."

ANOMIA OBLIQUA, Meek & Hayden.

Anomia obliqua, Meek & Hayden. 1860. Proc. Ac. Nat. Sc., Phil., p. 181; also Meek, 1876, in U. S. Geol. Surv. Terr., vol. IX., p. 22, pl. 9, fig. 2.

Vermilion River, Township 24, Range 20 W., and Ochre River, Township 22, Range 17 W., J. B. Tyrrell, 1887: two rather small upper valves from each of these localities. All from the Niobrara group, or upper portion of the series.

INOCERAMUS PROBLEMATICUS, Schlotheim.

Ostracites labiatus, Schlotheim. 1813. Bronn's Jahrb., vol. VII., p. 93.

Mytilites problematicus, Schlotheim. 1820. Petrefactenk, vol. I., p. 302.

Mytiloides labiatus, Brongn, 1822. Cuv., Oss. Foss., pl. 3, fig. 4, in Geol. des env. de Paris.

Inoceramus mytiloides, Mant. 1822. Geol. of Sussex, p. 215, pl. 27, fig. 2, and pl. 28, fig. 2.

" " Sowerby. 1823. Min. Conch., vol. V., p. 62, pl. 442.

" " Goldfuss. 1835. Petref. Germ., vol II., p. 188, pl. 113, fig. 4.

Inoceramus problematicus, d'Orbigny. 1843. Pal. Franc., Terr. Cret., vol. III., p. 510, pl. 406.

Inoceramus labiatus, Stoliczka. 1871. Palæont. Ind., vol. III., Cret. Pelecyp. S. Ind., p. 408, pl. 29, fig. 1.

Inoceramus problematicus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 62, pl. 9, figs. 3, a, b.

Swan River and Thunder Hill, J. W. Spencer, 1874: a few specimens from each of these localities.

Vermilion River, Riding Mountain, Section 7, Township 24, Range 20 W., T. A. Burrows, 1886: a perfect cast of the interior of a left valve.

Ochre River, Township 22, Range 17 W., eleven specimens; Edwards Creek, Township 23, Range 19 W., two specimens; Vermilion River, Township 25, Range 20 W., nine specimens; Wilson River, Township 25, Range 21 W., two specimens; Valley River, Township 25, Range 21 W., one specimen, and Range 22 W., in the same Township, one specimen; Rolling River, two miles above the old C. P. R. crossing, one specimen; J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W., three specimens, D. B. Dowling, 1887. All from the Niobrara group, or upper part of the series.

The specimens collected at these localities are usually little more than imperfect casts of the interior of detached valves, but they represent the typical form of the species rather than the variety *aviculoides* of Meek and Hayden.

On account of its real or supposed earlier date, a question which the present writer has no means of investigating, the name *I. labiatus* is preferred to *I. problematicus* by Stoliczka and some other German palæontologists.

MODIOLA TENUISCULPTA. (N. Sp.?)

Plate 26, figs. 2 and 2a.

Shell elongated, compressed, the length being more than twice the height, and the greatest thickness through the closed valves about one-third less than their maximum height; umbonal slopes rounded, nearly obsolete, and not at all angulated. Superior border moderately elevated and somewhat angular a little behind the middle; hinge line straight, occupying rather more than one-half of the entire length, and forming a very obtusely subangular junction with the obliquely convex downward slope of the anal margin; postero-basal extremity rather narrowly rounded; basal margin shallowly concave; anterior extremity forming a subangular, but somewhat rounded, narrow lobe which projects a short distance beyond the beaks, the latter being small, depressed and appressed, with a forward inclination.

Surface marked by fine and very numerous radiating ribs, which bifurcate at irregular intervals, and which are crossed by extremely minute concentric striæ, as well as by a few distant and impressed periodic arrests of growth. The radiating ribs are coarser above the nearly obsolete umbonal slopes than they are below them, and the concentric striæ which cross them are too small to be visible without the use of a lens.

Characters of the interior of the valves unknown.

Dimensions of the most perfect specimen collected: maximum length, fifty-three millimetres; greatest height, twenty-two mm.; breadth or thickness, fourteen.

Swan River, Township 37, Range 26 W., J. B. Tyrrell, 1887: a somewhat imperfect cast of the interior of the closed valves, with a small portion of the test preserved, and a well preserved portion of the mould of a detached valve. Rolling River, Township 35, Range

26 W., J. B. Tyrrell, 1887: an imperfect right valve. All from the Fort Benton group, or lower part of the series.

The specimens described above seem to be very nearly related to the *Volsella** (*Brachydontes*) *multilinigera*† of Meek, from "Cretaceous sandstones at Coalville, Utah," but they appear to differ therefrom in their much more broadly rounded umbonal slopes, and in the greater prolongation of their anterior extremity beyond the beaks.

CEPHALOPODA.

BELEMNITELLA MANITOBENSIS. (N. Sp.)

Plate 26, figs. 3, 3a and 3b.

Guard of medium size, elongated and projecting beyond the apex of the phragmocone to a distance of about four inches, acutely pointed posteriorly and subcylindrical anteriorly; apex eccentric; outline of a transverse section at the thicker end broadly ovate or ovately subcircular. Vascular impressions consisting of two distinctly defined, longitudinal and nearly straight, impressed lines, one of which is placed on each side of the narrowest part of the guard, and presumably, therefore, on its dorsal surface. These dorsal impressions commence at a short distance from the apex and extend to the broken anterior termination of each specimen. The central portion of the presumed ventral surface is marked also by a somewhat similar, but not quite so clearly defined, median impressed line, and by a few extremely faint and irregular impressed striæ, which run nearly parallel with it, but which radiate slightly outwards towards the apex. Apart from these longitudinal markings, the general surface is perfectly smooth. Alveolar cavity and phragmocone unknown.

East bank of the Assiniboine River, a short distance below the mouth of the Little Souris River, D. Armit, 1876: one specimen. Ochre River, Riding Mountains, D. Armit, 1884: one specimen.

Vermilion River, Township 24, Range 20 W.; one specimen: South Duck River, Township 34, Range 23 W.; one fragment: Swan River, Township 35, Range 29 W.; one fragment: J. B. Tyrrell, 1887.

Assiniboine River, Section 36, Township 8, Range 11 W., Warren Upham, 1887: one specimen. All from the Niobrara group, or upper part of the series.

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* Mr. Meek has claimed that the name *Volsella*, Scopoli, should be used for this genus rather than *Modiola*, Lamarck, but in this view he is not followed by authors of the most modern manuals of palæontology or conchology.

† U. S. Geol. Surv. Terr., Contr. to Palæont., by Dr. C. A. White, 1880, Nos. 2-8, p. 18, pl. 11, fig. 3 a.

The few specimens which have been collected at these localities are here referred to the genus *Belemnitella* rather than to *Belemnites* proper, on account of their surface being marked with distinct vascular impressions. They all consist of the posterior, fibrous portion of the guard, broken off at greater or less distances behind the apex of the phragmocone. As not a vestige of the alveolar border is preserved, it is quite uncertain whether the anterior margin of the latter had a straight fissure on its ventral side or not.

The species seems to be readily distinguishable from the most nearly related North American species, the *Belemnitella bulbosa* of Meek and Hayden from the Fox Hills group of Dakota, by its much greater size, less slender proportions and by the different outline of its transverse section at the larger end.

Although in Meek's extended definition of the generic characters of *Belemnitella*,* the surface of the guard is said, perhaps inadvertently, to be marked "on the *ventral* side by distinct vascular markings," yet in d'Orbigny's original description of that genus the two lateral vascular impressions are stated to be *dorsal*.

ARTHROPODA.

CRUSTACEA.

CIRRIPEDIA.

LORICULA CANADENSIS. (N. Sp.)

Plate 26, figs. 4 and 4a.

The foregoing name is proposed for the unusually perfect specimen of a species of *Loricula* figured on Plate 26, which was collected by Mr. J. B. Tyrrell, in 1887, at South Duck River, in Township 34, Range 23 W., from the Fort Benton group, or lower portion of the series.

Of the nine plates of which the capitulum was originally composed no fewer than seven, viz., the carina, three of the four lateral plates, (*i.e.*, two on the under surface and one on the upper),one tergal plate, and two of the scuta (the one on the under side nearly covered by that on the upper) are preserved, more or less entire, in this specimen. Most of one side of the scaly peduncle, also, is preserved, though the whole of the exterior row of narrow plates immediately under the carina is absent, and the posterior or pointed end of the peduncle is imperfect, most of the scales in that region being considerably displaced.

The present species resembles the type of the genus, the *L. pulchella* of Sowerby, very closely in the number, shape and relative arrangement of the capitular plates and scales on the peduncle, as well as in the surface markings of the former, but it seems to differ materially from *L. pulchella* in its much smaller size and more narrowly subfusiform lateral outline, while the scales of its peduncle appear to be more obliquely disposed and not at all curved. In the figure of *L. pulchella* in Darwin's Monograph on the British Fossil Cirripedes (published by the Palæontographical Society), which is stated to be of natural size, the maximum height of the entire organism is twenty-six millimetres and a half, and its greatest breadth sixteen mm. and a half. The greatest breadth of the specimen collected by Mr. Tyrrell is seven millimetres, and although its exact height cannot be accurately ascertained, it may be approximately estimated at fourteen, or perhaps, fifteen mm.

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*Rep. U. S. Geol. Surv. Terr., vol. IX., p. 502.

Judging by woodcut 721 a. on page 536 of the second volume of Zittels' "Handbuch der Palæontologie," the present species would seem to be more nearly related to the *L. lævissima* of Zittel, from the upper chalk of Westphalia, than to *L. pulchella.*

A few isolated capitular plates of *L. Canadensis* were also collected by Mr. Tyrrell in 1887, at the Vermilion River, in Township 24, Range 20 W., from the Fort Benton group, or lower part of the series.

FISHES.

SELACHII.

PTYCHODUS PARVULUS. (N. Sp.)

Plate 26, figs. 5, 5a and 5b.

Tooth (in the only specimen known to the writer) very small for the genus: the crown conical, with obliquely compressed sides, its maximum height being about equal to its breadth at the base, though, as its apex is somewhat worn down from use, its original height may have slightly exceeded its breadth. Outline of the base of the crown, as viewed from above, somewhat quadrangular and much longer than broad, but its posterior end is deeply excavated in the centre and produced on both sides into a small and short process, which expands slightly outward and is truncated and minutely grooved at its termination. Lateral outline of the base of the crown, shallowly concave: characters of the root unknown.

At the anterior end of the crown there is a triangular smooth space, but the rest of its surface is marked by corrugations or ridges, which appear to have crossed the summit and posterior end continuously. At the posterior end the continuity of three of the corrugations or ridges, from the base of one side to that of the other, is still clearly visible, and there is a certain amount of regularity in their disposition. In the central portion the wearing down of the summit has destroyed their continuity, and on the sides the corrugations are so much abraded as to be nearly obsolete. Near the anterior end the corrugations on the sides are more irregular in their shape and disposition than at any other part of the surface, and those which correspond to each other, on the two opposite sides, are seldom, if ever, exactly alike. Thus, on the right hand side of the crown, one of the corrugations close to the front branches three or four times below the middle, and its longest branch bends inward at nearly a right angle to the main stem and to the rest of the corrugations, but this is not the case with the corresponding one on the opposite side, and in no part of the surface do the corrugations cross each other sufficiently often to form a complete, or even partially complete, network. Under a lens also, the external orifices of the dentinal tubuli are plainly visible through the polished transparent enamel, and where the latter is worn away, as on the summit and at the anterior end, the orifices themselves are exposed and appear as close-set punctures of irregular shape.

Dimensions of the only specimen collected: maximum length of the crown, nine millimetres and three-quarters; actual height of the crown, as measured in the centre, six mm.; breadth of the crown at its base, also as measured in the centre, six mm.

Swan River, below Thunder Hill, J. W. Spencer, 1874: one specimen, which consists of the whole of the crown and a small portion of the roots of one of the palatal teeth. From the Niobrara group, or upper part of the series.

In its general shape, especially as seen from above, and in the peculiar ornamentation of its crown, this tooth appears to differ from those of any of the previously characterized species of *Ptychodus* from the Cretaceous rocks of North America, but, until a larger series of specimens shall have been obtained, its specific relations must remain doubtful.

LAMNA MANITOBENSIS. (N. Sp.)

Plate 26, figs. 6, 6a and 6b.

Perhaps a variety of *Lama macrorhiza*, Cope.

Cfr. *Lamna macrorhiza*, Cope. 1875. Vert. Cret. Form. West (Rep. U.S. Geol Surv. Terr., vol. II)., p. 297, pl. 42, figs. 9, 10.

" " A. S. Woodward. 1889. Cat. Foss. Fishes Brit. Mus., p. 399.

Teeth rather small; crown or enamelled portion of each tooth consisting of a central and nearly equilateral principal cusp or cone, with one well developed denticle on each side of its base: root deeply but narrowly and not at all angularly forked, the two radicles being nearly parallel and but slightly divergent, with their ends narrowly rounded. Central cusp of the crown slightly recurved, conical and rather slender, its height, as measured on the longer and flatter of the two sides, being more than twice its breadth at the base, which latter, as viewed edgeways, is oblique, the plane face descending far below the convex. Outer coronal face nearly flat, but marked with a shallow longitudinal depression or faint groove on each side, next to the lateral margins, the intervening central space being nearly flat or very slightly convex,—but its basal portion is ornamented also with a few acute and longitudinal plications of unequal size and length, the two nearest to the centre being longer and larger than any of the others. Inner coronal face convex, especially below, the greater part of its surface marked by numerous (about sixteen) irregular and longitudinal, but not quite straight, acute ridges or plications, some of which are comparatively short and do not extend the whole length of the cusp, while those that do usually bifurcate or trifurcate at the base. When examined with a lens, however, this plicated area is seen to be bordered with a narrow, smooth space, on both sides and next to the lateral margins. Cutting edge thin and sharp, with a minute tubercle at the base, on each side.

The lateral denticles are triangular, with their apices slightly divergent and pointing upward and outward: their height and breadth are about equal. On their outer side they are nearly flat and on their inner convex, while the ornamentation on both sides of the surface is essentially similar to that of the central cusp of the crown, though the plications on their inner or convex side, while equally well marked, are of course not nearly so numerous. The root also is nearly flat on its outer side, but on its inner face it is everywhere more or less convex, and immediately under the base of the central cusp it swells up into an elevated protuberance with a rounded summit.

The foregoing description is based upon two nearly perfect detached teeth collected by Mr. Tyrrell, in 1887, at Rolling River, two miles above Heart Hill, from the Niobrara group or upper portion of the series. The dimensions of one of these specimens, which is figured on Plate 26, are as follows: entire height, from the base of one of the radicles to the summit of the central cusp, eighteen millimetres; breadth of the tooth, near the base of the root and below the two denticles, nine mm. and a half; height of central cusp, ten mm. and a half on the outer or flattened side and seven mm. and a half on the inner; breadth of the same at the base, four mm. and a half.

A few dental crowns of similar teeth were collected by Mr. Tyrrell in the same year at the Rolling River, in Township 36, Range 26 W., but only one of these has the lateral denticles preserved. In this latter specimen, whose inner or convex surface is buried in the matrix, the central cusp is exceptionately long and slender, and the plications at the base of its outer surface are unusually short, small and nearly uniform in size.

The detached teeth for which the present provisional name is proposed, seem to differ from those of the *L. macrorhiza*, from the "Niobrara epoch" of Kansas, in their proportionately broader and shorter dental crowns, in their very slightly divergent and nearly horseshoe-shaped roots, and more particularly in the distinctly though minutely plicated surface of their inner coronal faces.

TELEOSTEI.

Enchodus Shumardi, Leidy.

Plate 26, figs. 7, 7a, 7b and 7c.

Enchodus Shumardi, Leidy. 1873. Contr. Extinct Vert. Faun. W. Terr. (U.S. Geol. Surv. Terr., vol. 1) p. 289, pl. 17, fig. 20.

A small slab of shale whose fossiliferous surface is strewn with displaced portions of the jaws, with the teeth *in situ*, and detached teeth of a small species of *Enchodus*, was collected by Mr. Tyrrell in 1887, on the Rolling River, two miles below the old C. P. R. crossing, from the Niobrara group or upper part of the series. These remains are probably referable to the *E. Shumardi* of Leidy, a species which was based upon a dentary bone with teeth, found by Dr. Benjamin F. Shumard in ash-coloured shales of the Cretaceous series of Nebraska, though, judging by the description, and more especially by the figures, in the fifth volume and atlas to the fifth volume of the "Poissons Fossiles," it is difficult to see by what characters they can be distinguished from the *E. halocyon* of Agassiz.

The specimen collected by Mr. Tyrrell, like the fragment described by Dr. Leidy, shows that in this species the lower jaw was armed with nearly straight and erect, but very slightly incurved, slender teeth, placed at rather distant intervals, and that these teeth are of unequal size, the one nearest the anterior end of each ramus being much longer than any of the rest. Impressions of the greater part of each of the dentary bones, with the teeth in place, are preserved, and the surface ornamentation of part of the lower jaw is very well exhibited. The most perfect of the dentary bones indicated in the specimen figured (fig. 7) is forty millimetres long and thirteen mm. broad or deep at its broken posterior extremity, and its upper margin is armed with six teeth, the largest of which is nine millimetres high and three mm. broad at the base. The external surface of the dentary portion of the lower jaw (fig. 7a) is finely ribbed in a longitudinal direction, and the summit of each rib bears a single row of minute and closely arranged tubercles. One little bone, (fig. 7c) which is very similar in its shape and in the general style of its dentition to the palatine bone of *E. halocyon* as described and figured by Agassiz, but which is most probably one of the maxillaries, has its under margin fringed with a single row of very minute teeth, though these latter are of very nearly equal size, and not of distinctly different sizes as they are represented as being in the palatine bone of *E. halocyon*. A long and slender tooth, (fig. 7b) whose longitudinally striated exposed portion is fourteen millimetres long and only two mm. broad at the base, to the basal portion of which a small fragment of bone is still adherent, is evidently one of the elongated fangs at the anterior extremity of the premaxillary.

In 1875, the genus *Enchodus* was included by Professor Cope in a new family of physostomous fishes, for which the name Stratodontidæ* was proposed, an arrangement which has since been adopted by Zittel in the third volume of his "Handbuch der Palæontologie."

CLADOCYCLUS OCCIDENTALIS, Leidy.

Plate 26, figs. 8 and 9.

Cladocyclus occidentalis, Leidy. 1873. Contr. Extinct Vert. Fauna West. Terr. (Rep. U. S. Geol. Surv. Terr., vol. I.) p. 288, pl. 17, figs. 21, 22, and pl. 30, fig. 5.

Ochre River, Township 23, Range 17 W., eight specimens; Edwards Creek, Township 23, Range 19 W., one specimen; Vermilion River, Township 25, Range 20 W., one specimen; Rolling River, two miles above the old C. P. R. crossing, four specimens; and Favell River, Township 35, Range 26 W., one specimen: J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W., one specimen: D. B. Dowling, 1887. All from the Niobrara group, or upper portion of the series.

The name *C. occidentalis* was proposed by Dr. Leidy for a number of large, detached cycloid scales "found by Dr. John E. Evans and subsequently by Prof. Hayden and Mr. Meek in ash-colored shales of the cretaceous series of Nebraska." "Mostly," Dr. Leidy says, "they are oval, with the length but little more than half the depth, while others are circular, and these may really pertain to a different species, if not genus, from the former." In one of these scales, the depth of which "is estimated to have been nearly 2½ inches, and its length nearly 1½ inches," the inner portion is described as exhibiting "numerous radiating ridges, while the outer portion, separated from the former by a narrow, smooth tract, presents a minutely tubercular or granular aspect."

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* Vert. Cret. Form. West. (Rep. U. S. Geol. Surv. Terr., vol. II.) p. 218.

The specimens collected by Messrs. Tyrrell and Dowling from the northern continuation into Manitoba of the Cretaceous rocks of Dakota, at the localities indicated, are all large detached scales, which are very similar in size and shape to those described by Dr. Leidy, and which do not appear to differ from them except in some minute details of their surface ornamentation. Like those from Nebraska, too, they may represent more than one species, and, perhaps, even more than one genus.

Of the two specimens figured, one (fig. 8), which measures forty-seven millimetres (or nearly two inches) in depth and twenty-four mm. (or about one inch) in length, is somewhat pointed above and below, while its lateral margin is broadly rounded anteriorly and nearly straight posteriorly. In the other, (fig. 9), which is twenty-nine millimetres in depth and twenty-nine mm. and a half in length; the marginal outline is more nearly circular. When examined with a lens, the radiating markings on the surface of each are seen to consist of fine grooves, which are more or less interrupted or broken up into rows of punctures, and not of continuous raised ridges as in the types of *C. occidentalis.* The smooth central area is well marked in both and in all the specimens collected, and the granulations on the exposed surface of each scale appear under the lens as longitudinal but slightly divergent and densely crowded rows of minute punctures with raised margins, the punctures in each row being connected by a still more minute ridge.

ERRATA.

Page 116. Immediately under the words "GRAMMYSIA ARCUATA? Conrad, Var.", add Plate 15, fig. 4.

Page 133. Line 21 from the bottom, for "Wissman" read Wissmann.

Page 138. Line 7 from the bottom, for "species" read specimens.

Page 165. Between the running heading at the top and the first line below it, insert the word LAMELLIBRANCHIATA.

Page 169. Line 2 from top, for "PROTOCARDIUM HILLANUM" read "PROTOCARDIA HILLANA, for although Woodward, Stoliczka and Tryon write the name of Beyrich's genus PROTOCARDIUM, yet Meek, Paul Fischer and Zittel claim that the original spelling of the word is PROTOCARDIA.

GEOLOGICAL SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME 1.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART III.

5. The Fossils of the Devonian Rocks of the Mackenzie River Basin.

PRINTED FOR THE GOVERNMENT OF CANADA.

WILLIAM FOSTER BROWN & CO., PUBLISHERS,
MONTREAL.
1891.

The Third Part, herewith presented, of the "Contributions to Canadian Palæontology," consists of an illustrated report on all the fossils now in the Museum of the Survey from the Devonian Rocks of the Mackenzie River basin, and especially on those collected by Mr. R. G. McConnell, in the years 1887–90, both inclusive.

It consists of fifty seven pages of text, illustrated by six full page plates, lithographed by Messrs. Mortimer & Co., of Ottawa, from original drawings made by Mr. L. M. Lambe, the artist to the Survey.

The Fourth and concluding Part, which will consist of a similar report on the Fossils of the Devonian Rocks of Manitoba, is now in course of preparation.

ALFRED R. C. SELWYN.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, May 1st, 1891.

GEOLOGICAL SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

5. *The Fossils of the Devonian Rocks of the Mackenzie River Basin.*

In 1887, 1888 and 1889 large and important collections of fossils were made by Mr. R. G. McConnell from the Devonian rocks exposed along the Hay, Mackenzie and Peace Rivers. A detailed report upon the species contained in these collections was written, and the five plates required to illustrate it were printed off, in the fall of 1890. Before the manuscript of this report was sent to the printer, however, the receipt of an additional collection of fossils, made by Mr. McConnell in 1890 from the Devonian rocks of the Athabasca and Pembina Rivers, induced the writer to enlarge its scope so as to include therein a consideration of all the specimens now in the Museum of the Survey from the Devonian rocks of the Mackenzie River Basin. The whole of the specimens referred to in these pages were collected by members of the Staff of the Survey between the years 1875 and 1890, both inclusive, and some of the collections made prior to 1885 have been provisionally reported upon by the writer, in the Reports of Progress of the Survey for the years in which they were made. In the study and comparison of many of the species represented in these collections, and especially in ascertaining the internal structure of the corals and the minute peculiarities of the polyzoa, the writer has been ably assisted by Mr. L. M. Lambe.

SPONGIÆ.

ASTRÆOSPONGIA HAMILTONENSIS, Meek and Worthen.

Plate 28, figs. 1, 1a.

Astræospongia Hamiltonensis, Meek and Worthen. 1866. Proc. Chicago Ac. Sc., vol. I, p. 12.

Astræospongia Hamiltonensis, Meek and Worthen. 1868. Geol. Surv., Illinois, vol. III, p. 419, pl. 10, fig. 6.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: the solitary six rayed spicule figured, which is somewhat doubtfully referred to this species. It appears to be about one third smaller than the figured spicules of the typical *A. Hamiltonensis*, the former being about two millimetres in its maximum diameter and the latter about three in theirs. Isolated spicules precisely similar to that of the Hay River *Astrœospongia* are found in the Hamilton Formation at Thetford and at Bartlett's Mills, near Arkona, Ontario.

ANTHOZOA.

ALCYONARIA.

AULOPORA SERPENS, Goldfuss.

Tubiporites serpens? Schlotheim. 1820. Petrefact., pt. 1, p. 367.
Aulopora serpens, Goldfuss. 1826.* Petref. Germ., vol. I, p. 82, tab. xxxiii, fig. 2.
" " Rominger. 1876. Geol. Surv. Mich., Foss. Corals, p. 86, pl. xxxiii, fig. 2.
" " Walcott. 1884. Palæont. Eureka distr. Nevada, p. 103.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen parasitic upon *Atrypa reticularis*.

This little coral seems to be in no respects dissimilar to the fossils from the Hamilton Formation of Michigan and from the Lower Devonian of Gray's Canon in the Eureka district of Nevada, which have been referred to *A. serpens* by Dr. Rominger and Mr. Walcott. It is, however, not yet certain that the specimens from these three localities are precisely identical with the species described by Schlotheim and Goldfuss.

The systematic position of the genus *Aulopora* has long been doubtful and is still far from settled. In their monograph of the British Fossil Corals (1850-54), Edwards and Haime refer it to the *Alcyonaria*, but in their subsequently published "Polypiers Fossiles des Terrains Palæozoiques" they create for it the special order *Zoantharia Tubulosa*, composed of the single family *Auloporidœ*, and place both between their *Tabulata* and *Rugosa*. Nicholson, in the last edition of his Manual of Palæontology (1889) refers *Aulopora* to the *Alcyonaria*, but Ferdinand Rœmer, in the Lethea Geognostica (1876) places it at the end of the

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* Rœmer (Lethea Geognost., 1, 521) gives the date of this species as 1826, and Edwards and Haime (Polyp. foss., p. 312) as 1829. The first volume of the Petref. Germaniæ bears date 1826-33.

Zoantharia under the heading "incertæ sedis," and Zittel in his "Handbuch der Palæontologie" (1883) quotes it in an appendix to the *Zoantharia* under the title "Genres du Groupe des Tabulata et Tubulosa E. and H. de position systématique incertaine."

ZOANTHARIA.

STREPTELASMA RECTUM, Hall.

Plate 27, figs. 1, 1a and 2.

Strombodes rectus, Hall. 1843. Geol. N. Y., Surv. Fourth Distr., pp. 209-210.
Cyathophyllum rectum, Edwards and Haime. 1851. Polyp. foss. Terr. Palæoz., I, p. 372.
Streptelasma recta, Hall. 1876. Illustr. Dev. Foss., pl. xix, figs. 1-13.

Mackenzie River, ten miles below Bear River, R. G. McConnell, 1888: three specimens which seem to agree with the descriptions and figures of this species.

CYATHOPHYLLUM ARCTICUM, Meek.

Cyathophyllum arcticum, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 79, pl. xi, fig. 8.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: two good specimens, which correspond fairly well with Meek's description of one of the forms of this species. Mr. Meek, however, expressed the opinion that *C. arcticum* "resembles *C. quadrigeminum* of Goldfuss, as figured on pl. xviii, fig. 6b of his Petrefacta Germaniæ, more nearly than any other species" with which he was acquainted. In the writer's judgment, the two specimens collected by Mr. McConnell are much more like *C. hexagonum*, as originally described and figured by Goldfuss, and subsequently by Edwards and Haime, the Sandbergers, Ferdinand Rœmer and others, if, indeed, they are not actually identical therewith. Both specimens are small convex masses of intimately connected, polygonal and for the most part hexagonal corallites, the apertures of the larger ones measuring as much as fifteen millimetres in their maximum diameter. The number of septa is essentially the same as those of *C. hexagonum*, but in the specimens from the "Ramparts" the writer has not been able to detect any traces of the paliform lobes on the septa, which, according to Edwards and Haime, "form a very distinct crown round the centre of the calice" in *C. hexagonum*.

CYATHOPHYLLUM CÆSPITOSUM, Goldfuss.

Plate 27, figs, 7, 8.

Cyathophyllum cæspitosum, Goldfuss. 1826. Petref. Germ., vol. I, p. 60, tab. xix, fig. 2.

Cyathophyllum hexagonum (pars.) " " Ibid. tab. xix, figs. 5a, b, c. (cæt. excl.)

Caryophyllia dubia, DeBlainville. 1830. Dict. Sc. Nat., vol. LX, p. 311. Man., p. 345.

Cyathophyllum cæspitosum, Milne Edwards. 1836. 2nd ed. Lamarck, vol. II, p. 428.

Cyathophyllum cæspitosum, Lonsdale. 1840. Geol. Trans. 2nd ser., vol. V, pt. 3, pl. lviii, fig. 8.

Cyathophyllum cæspitosum, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somerset, p. 9, pl. iii, fig. 10.

Cladocora Goldfussi, Geinitz. 1845-46. Grundr. der Verst., p. 569.

Diphyphyllum cæspitosum, D'Orbigny. 1850. Prodr. de Paléont., vol. I, p. 106.

Cyathophyllum cæspitosum, Edwards and Haime. 1851. Polyp. Foss. des Terr. Palæoz., p. 384.

Cyathophyllum cæspitosum, McCoy. 1851. Brit. Palæoz. Foss., p. 69.

" " Edwards and Haime. 1850-54. Brit. Foss. Corals, p. 229, tab. li, figs. 2, 2a, 2b.

Peace River, near the mouth of Little Red River, Prof. Macoun, 1875: a small mass of loosely aggregated corallites. Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few single corallites, two of which are figured. These very closely resemble what Goldfuss calls the "coni segregati" of *C. hexagonum*, and figures as such on tab. xix, figs. 5a, b, c, of the "Petrefacta Germaniæ," though Edwards and Haime have shown that these are forms of *C. cæspitosum*. Their internal structure is essentially the same as that of the mass of compound corallites from the Peace River, but it is just possible that the specimens from the Hay River may be single corallites of Meek's *C. arcticum*.

CYATHOPHYLLUM RICHARDSONI, Meek (Sp.)

Plate 27, figs. 3 and 4.

Aulophyllum ? Richardsoni, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 81, pl. xi, fig. 3.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: six good specimens.

Although Mr. Meek placed this species provisionally in the genus *Aulophyllum*, he expressly stated that he was quite uncertain whether it ought to be referred to that genus or to *Cyathophyllum*. On this point his exact words are as follows:—"I know this coral only from fragments less than 0.80 inch in diameter, none of which shew the entire length. They are also nearly all considerably compressed, but this seems to be from accidental pressure. The generic characters cannot be made out with much confidence from such materials, and hence I am by no means satisfied that the species should not be called *Cyathophyllum Richardsoni*. As near as its internal structure can be determined, however, from the specimens collected, it would seem to differ from that genus in having an inner wall encircling the central region, and thus more nearly approaching the genus *Aulophyllum*. It also wants the transverse tabulæ generally more or less developed in the central region of *Cyathophyllum*."

The specimens upon which Mr. Meek's description was based, which are also from the "Ramparts," have been kindly lent to the present writer, for examination and comparison, by Mr. C. D. Walcott, of the U. S. Geological Survey. Their internal structure, it may be stated, is in a peculiar and not very good state of preservation. In those of which sections have been made, the appearance of a supposed "inner wall encircling the central region" seems to be due to the fact that the matrix filling up the vesicles of a narrow outer zone which corresponds in breadth to the length of the secondary septa, happens to be of a distinctly darker colour than that which fills up the vesicles of the central portion of the coral. In these and in the much better specimens collected by Mr. McConnell, the writer has failed to find any indications of an "inner wall" like that of *Aulophyllum*, and has consequently been induced to refer the species to *Cyathophyllum*.

In longitudinal sections the specimens obtained by Mr. McConnell shew that from the bottom of the calyx to the base of the coral the primary septa extend to the centre, where they are slightly twisted. There are no tabulæ proper, but the spaces between all the septa are everywhere filled with vesicular tissue, the vesicles being larger and less regular in the central area than they are exteriorly. The most perfect specimen collected, which measures about three inches in length, has its epitheca densely and finely striated across, in addition to the ordinary surface markings.

CYATHOPHYLLUM ATHABASCENSE. (N. Sp.)

Plate 32, figs. 1, 1a, b.

Corallum simple, elongate-turbinate and slightly curved: epitheca well developed, marked with rounded and not very prominent longitudinal ribs, which are much broader than the grooves between them, and by transverse striæ or wrinkles and an occasional constriction caused by an arrest of growth. Calyx circular, rather deep, with steep sides: septa about thirty four in number, simple, not bearing arched carinæ on their sides and apparently not denticulated at their summits. Interior structure, as seen in longitudinal sections, consisting of an outer or peripheral zone of oblique ascending rows of rather large vesicles, and of a broad central area in which the interstices between the septa are crossed by large curved dissepiments, whose size, shape and disposition are very irregular. Transverse sections made a little below the base of the calyx shew that the thirty four septa extend almost to the centre, and that they are all equal in length.

Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: three good specimens.

The largest of these is strikingly similar in shape and in surface markings to the *Cyathophyllum ceratites* of Goldfuss as figured by the Sandbergers on plate xxxvii of their memoir on the fossils of the Devonian rocks of Nassau, but in *C. ceratites* there are said to be from sixty to one hundred and twenty subdenticulated septa.

CAMPOPHYLLUM ELLIPTICUM.

Plate 27, figs. 5, 6.

Chonophyllum (*Ptychophyllum*) *ellipticum*, Hall and Whitfield. 1873. Twenty-third Rep. Reg. N. York. St. Cab. Nat. Hist., p. 233, pl. ix, fig. 13.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: three specimens, each of which has been slit longitudinally through the centre and the cut surfaces polished.

On treating in the same way a specimen of a coral from the Devonian shales at Rockford, Iowa, recently forwarded for comparison by Dr. H. G. Griffiths of Burlington, in that State, and labelled by him *Chonophyllum ellipticum*, the writer was surprised to find that its internal structure and external characters are essentially the same as those of the specimens from the Hay River. In all four there is no satisfactory evidence of the existence of "infundibuliform cups," but the internal structure, as represented in fig. 6, consists of a broad central tabulate area surrounded by an outer and rather narrow peripheral zone composed of large vesicles. The tabulate area occupies about three fifths of the entire diameter, the tabulæ are close-set, flat and for the most part continuous, and their outer terminations are bent abruptly downward. In the outer vesicular zone the general direction of the rows of vesicles in the interseptal loculi is upward and outward. A transverse section of the specimen represented by fig. 6, made at a distance of about half an inch from the bottom of the cup, shows that the primary septa reach nearly if not quite to the centre, and the secondary ones a quarter of the way.

In their description of *Chonophyllum ellipticum* Professors Hall and Whitfield say that "there may be some doubt as to its generic relations." If the specimen from Rockford, forwarded by Dr. Griffiths, be correctly referred to that species, its internal structure would seem to show that it is congeneric and even perhaps conspecific with the *Campophyllum Soetenicum* of Schluter,* from the Middle Devonian of the Eifel.

A single specimen of a rather elongated and narrow variety of this species has since been collected (in 1890) on the Athabasca, thirty miles below Red River.

HELIOPHYLLUM PARVULUM. (N. Sp.)

Plate 27, figs. 9, 9a and 10.

Corallum small, simple, either nearly straight, subconical and not much longer than broad, as in the specimen represented by fig. 9, or somewhat bent, irregularly distorted in growth and proportionately rather narrower, as in the original of fig. 10, but apparently never either slender or narrowly elongated. Calyx circular in outline, moderately deep: septa thirty-six of each kind, at least in the broader of the two specimens figured, their edges, as seen in the cup, presenting a toothed appearance, which is due to the passing over them of arched carinæ: primary septa reaching nearly to the centre at the bottom of the cup: secondary septa very short and feebly developed: septal fossette lateral, shallow. Epitheca thin, transversely striated and wrinkled, with an occasional rather deep constriction, and marked also with longitudinal, rib-like markings which correspond to the septa within.

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* Anthozoen des Rheinischen Mittel-Devon, Berlin, 1889, p. 39, taf. iii., figs. 1-6.

Internal structure, as seen in a longitudinal section through the centre of each specimen, consisting of a narrow central tabulate area, surrounded by a broad, external zone of vesicular tissue. The tabulate area occupies about one fifth of the entire diameter, and the tabulæ are straight, regular and closely arranged. In the outer vesicular zone the vesicles are slightly smaller and more regularly disposed towards the outside than near the centre, their general direction being in rows which curve obliquely upward and outward. The general direction of the arched carinæ which cross the sides of the septa throughout their entire length, on the other hand, is uniformly upward and inward.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two perfect and well preserved specimens, both of which are figured.

PHILLIPSASTRÆA HENNAHI, Lonsdale.

Astræa Hennahi (pars), Lonsdale. 1840. Trans. Geol. Soc. Lond., Ser. 3, vol. V, p. 697, pl. lviii, fig. 3.

Astræa Hennahi, Phillips. 1841. Pal. Foss Cornw., Dev. and W. Somers., p. 12, pl. vi, fig. 16.

Smithia Hennahi, Edwards and Haime. 1851. Polyp. Foss. des Terr. Pal., p. 421.

Arachnophyllum Hennahi, McCoy. 1851. Brit. Pal. Foss., p. 72.

Smithia Hennahi, Edwards and Haime. 1853. Brit. Foss. Cor., p. 240, pl. liv, fig. 4: Meek, 1877, U. S. Geol. Expl. 40th Par., vol. IV, p. 32, pl. ii, figs. 6 and 6a.

Peace River, near Vermilion Falls, Professor Macoun, 1875, two specimens, and R. G. McConnell, 1889, three specimens, one of which measures fully seven inches in its greatest diameter. Hay River, forty miles above its mouth, R. G. McConnell, 1887: five specimens.

Those from the Hay River are very variable in external form, no two of them being exactly alike. In one the corallum is "depressed and moderately convex below," as in the type of *Smithia Verrillii*, Meek; in another the basal portion is so deeply conical that the entire depth of the coral is nearly equal to its maximum breadth at the summit, while a third is nearly spherical. The epitheca, which is beautifully preserved in the deeply conical specimen, has its outer surface finely and concentrically striated. The calices of the corallites, whose outer walls are conspicuously elevated, average about three millimetres and a quarter in diameter. They are placed at distances apart equal to from once to twice their own breadth, and their septa average eleven or twelve of each kind.

P. Hennahi occurs, though rarely, in the corniferous limestone of Ontario. Three specimens which appear to be identical with it are in the Museum of the Survey, two labelled "Woodstock, A. Murray," and the other "Cayuga, E. De Cew," each of which must have been collected more than twenty years ago.

PHILLIPSASTRÆA VERRILLII, Meek. (Sp.)

Smithia Verrillii, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 83, pl. xi, figs. 7a–b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens.

This coral seems to differ from the preceding species in the much less elevated outer edges of the calices of its corallites. Its calices, also, appear to be smaller and somewhat more distantly arranged than those of *P. Hennahi*, the average diameter of those of *P. Verrillii* being not quite two millimetres, and their septa usually eight or nine of each kind.

PACHYPHYLLUM DEVONIENSE, Edwards & Haime.

Pachyphyllum Devoniense, Edwards and Haime. 1851. Polyp. Foss. Terr. Palæoz., p. 397.

Pachyphyllum Devoniense, Edwards and Haime. 1854. Mon. Brit. Foss. Corals, p. 234, pl. lii, figs. 5 and 5a.

Peace River, between Vermilion Falls and the mouth of Little Red River, Professor Macoun, 1875: a single specimen whose internal structure corresponds much better with Edwards and Haime's diagnosis and figures of this species than with Hall and Whitfield's description of *P. Woodmani*, or with authentic examples of the latter coral from Iowa.

The specimen from the Peace River is an irregular convex mass, about ten centimetres or four inches in its maximum diameter, of compound corallites, which have no definite walls. The calices are strongly exsert and project considerably above the spaces between them. They average seven millimetres in diameter, and are separated by depressed spaces which in some places are wider than the calices themselves and in others narrower. Externally, the resemblance of the specimen to *P. Woodmani* is not inconsiderable. Transverse and longitudinal sections of both, however, show that the Peace River coral differs from *P. Woodmani* in that its corallites have no definite walls and no central tabulate area, as those of *P. Woodmani* have, and in its non-confluent costæ and septa which extend almost to the centre.

CYSTIPHYLLUM AMERICANUM, var. ARCTICUM.

Cystiphyllum Americanum, var. arcticum, Meek. 1868. Trans. Chicago Ac. Sc., p. 80, pl. xi, fig. 6.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one specimen.

PACHYPORA CERVICORNIS, De Blainville. (Sp.)

Calamopora polymorpha, var. *ramoso-divaricata*, Goldfuss. 1829. Petref. Germ., vol. I, p. 79, pl. xxvii, figs. 3a, 4a, 4b and 4c, (cæt. excl.)
Calamopora spongites, var. *ramosa*, Goldfuss. Ib., vol. I, p. 80, pl. xxviii, figs. 2a-2g. (cæt. excl.)
Alveolites cervicornis, De Blainville. 1830. Dict. Sc. Nat., p. 369, t. lx.
Alveolites reticulata, De Blainville. Ib., p. 369.
Favosites cervicornis, M. Edwards and Haime. 1851. Polyp. Foss. des Terr. Palæoz., p. 243: and (1853) Brit. Foss. Corals, p. 215, pl. xlviii, fig. 2 (?).
Favosites reticulata, M. Edwards and Haime. 1851. Polyp. Foss. des. Terr. Palæoz., p. 241: and (1853) Brit. Foss. Corals, p. 215, pl. xlviii, figs. 1, 1b.
Favosites polymorpha, Billings. (Pars.) 1859. Canad. Journ., N. S., vol. IV, p. 3 fig. 9.
Favosites polymorpha, Meek. 1868. Trans. Chicago Ac. Sc., vol. 1, p. 86, pl. xi, fig. 10.
Pachypora cervicornis, Nicholson. 1879. Struct. and Affin. Tabul. Cor. Palæoz. Per., p. 82, pl. iv, figs. 3, 3 a-d.

Peace River, between Vermilion Falls and the mouth of Little Red River, Prof. Macoun, 1875, and R. G. McConnell, 1889. Hay River, forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888. A few well preserved portions of branches of a coral which is somewhat doubtfully referred to this species, from each of these localities. These vary in thickness from half an inch to an inch and a half. In some the corallites are very small and in others comparatively large, but the lips of the calices are invariably thickened by a secondary deposit of sclerenchyma. Their apertures, which are often closed with opercula, are usually nearly or quite circular in outline, but they vary considerably in shape, those of one specimen, in particular, being transversely elliptical, with an obtusely conical protuberance at the base of each.

Lindstrom (Ovfersigt af Konigl. Vetensk. Akad. Forhandl., 1873, p. 22) and Ferdinand Rœmer (Lethaea Geognostica, 1883, Bd. 1, p. 435) claim that this species is the *Madreporites cristatus* of Blumenbach (1803), and that the proper name for it is *Pachypora cristata*, Blumenbach (Sp.). Edwards and Haime, on the other hand, had previously identified the *Madreporites cristatus* with a Wenlock limestone species, and in this view they are followed by Nicholson in his "Tabulate Corals of the Palæozoic Period."

ALVEOLITES VALLORUM, Meek.

Alveolites vallorum, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 86, pl. xi, fig. 9.

Hay River, forty miles above its mouth, R. G. McConnell, 1887, two specimens; Mackenzie River, at the "Ramparts," R. G. McConnell, 1888, four specimens; and Peace River, at Vermilion Falls, R. G. McConnell, 1889, one specimen.

ALVEOLITES RŒMERI, Billings.

Alveolites Rœmeri, Billings. 1860. Canadian Journal, New Series, vol. V, p. 255.
" " Nicholson. 1874. Rep. Palæont. Prov. Ontario, p. 54.
Cladopora Rœmeri, Rominger. 1876. Geol. Surv. Michigan, Foss. Corals, p. 50, pl. xx, fig. 3.

Peace River, near Vermilion Falls, Professor Macoun, 1875, eleven specimens, and R. G. McConnell, 1889, one fragment.

HYDROMEDUSÆ.

HYDROIDA.

ACTINOSTROMA WHITEAVESII, Nicholson.

Actinostroma Whiteavesii, Nicholson. 1891. Ann. and Mag. Nat. Hist., vol. VII, Sixth Ser., p. 320, pl. ix, figs. 3 and 4, also woodcut, fig. 2, in text.

Peace River, near the mouth of Little Red River, Professor Macoun, 1875: two specimens.

ECHINODERMATA.

CRINOIDEA.

ARACHNOCRINUS CANADENSIS. (N. Sp.)

Plate 28, figs. 2 and 2a.

Calyx (or dorsal cup) very small, hemispherical and about one fourth broader than high. Underbasals small, apparently rhomboidal, but partly covered by the column: basals rather large, four pentagonal and one hexagonal, the height and breadth of each being about equal: radials a little broader than high, slightly larger than the basals, nearly hexagonal, the upper or outer angle of each hexagon being truncated and concavely excavated for the reception of the base of the first brachial, though the articulating scar of each radial does not occupy more than one half of the entire diameter of the plate: first brachials subquadrangular in outline and about twice as broad as high: second brachials five sided, much broader than high, their bases broad, their lower or inner sides short and slightly divergent, and their upper and outer sides shallowly concave: beyond this the characters of the arm plates are unknown. Anal plates two, both five sided with unequal sides, the first or lowest one about as broad as high, with a narrow base, and the second or upper one broader than high, with a broad base. Dome plates unknown: surface of the calyx smooth.

Approximate dimensions of the only specimen collected, which is a little distorted: height of the calyx, up to the base of the first brachials, six millimetres; greatest breadth of the calyx, eight mm.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen.

At the suggestion of Mr. Wachsmuth, who has examined the specimen, this interesting little crinoid is here provisionally referred to Meek's and Worthen's genus *Arachnocrinus*, though it appears to the writer to differ therefrom in having two small and simple anal plates and not one comparatively large one, which in *Arachnocrinus* is said also to support "a lateral tube which is in line with the arm bases."

VERMES.

SPIRORBIS OMPHALODES, Goldfuss.

Plate 28, figs. 3, 4, 4a, 5 and 5a.

Serpula omphalodes, Goldfuss. 1826-33. Petref. Germ., vol. 1, p. 225, pl. lxvii, fig. 3.

Spirorbis omphalodes, Nicholson. 1874. Rep. Palæont. Prov. Ont., p. 121, fig. 54a.

East bank of the Clearwater River, a few miles below the mouth of the Pembina, Professor Macoun, 1875, and A. S. Cochrane, 1881: five or six specimens, adherent to *Orthis striatula*. Hay River, forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few specimens which vary considerably in shape at different stages of growth, and which are always attached to brachiopods or corals.

In small specimens (such as the original of fig. 3) the outer volution is rounded and somewhat depressed and the umbilicus usually, though not always, comparatively wide. In large individuals (fig. 4) the outer volution is elevated and subangular and the umbilicus narrow. The surface is usually smooth or nearly so, but in some specimens (fig. 5) which seem to be nearly intermediate between this species and the next, the umbilical margin is seen to be distinctly plicated, when examined under a lens.

SPIRORBIS ARKONENSIS, Nicholson.

Spirorbis Arkonensis, Nicholson. 1874. Rep. Palæont. Prov. Ont., p. 121, figs. 54 b, c.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen attached to the dorsal valve of *Spirifera cyrtinæformis*.

Cornulites (Ortonis) sublævis. (N. Sp.)

Plate 28, figs. 6, 7.

Tube minute, conical, slender, slightly flexuous and attached throughout its entire length to some foreign body: aperture circular. Surface, as seen under a lens, nearly smooth and marked only with fine transverse lines of growth at irregular intervals.

Length of an average specimen, five millimetres: breadth of the same at the aperture, nearly a millimetre and a half.

Hay River, forty miles above its mouth, R. G. McConnell, 1887, and Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few specimens on shells and corals.

These differ from specimens of *Ortonia intermedia* of Nicholson, from the Hamilton Formation of Ontario,* in the entire absence of the "strong encircling, sometimes lamellose annulations or ridges" which are said to characterize that species, but tubes almost, if not entirely devoid of annulations, are occasionally found in the Hamilton shales at Thedford and Arkona, Ont.

POLYZOA.

Hederella Canadensis, Nicholson.

Plate 28, figs. 8 and 8a.

Alecto (?) *Canadensis*, Nicholson. 1873. Canad Nat., vol. VII, 2nd Ser., p. 146.
Stomatopora (?) *alternata*, Hall and Whitfield. 1873. Twenty-third Reg. Rep. St. N. Y., p. 235, pl. x, figs. 7, 8.
Aulopora (?) *Canadensis*, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 124, figs. 57a–e.
Hederella Canadensis, Hall. 1881. Trans. Alb. Inst., vol. X, p. 194.
" " " 1885. Rep. St. Geol. for 1883, p. 53.
" " " 1887. Pal. St. N. Y., vol. VI, p. 277, pl. lxv, figs. 1-8, 14-16.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few colonies attached to *Phillipsastræa Hennahi*, *Orthis striatula*, *Spirifera disjuncta* and *Atrypa reticularis*. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: two specimens, attached to *Orthis striatula*.

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* Rep. Palæont. Prov. Ontario, 1874, p. 122, figs. 55 a, b.

The size of specimens of the present species seems to be determined by that of the objects to which they are attached. When growing upon the surface of comparatively large corals the colonies attain to a length of two inches or more, but when attached to the shells of brachiopoda of medium size (such as *Orthis striatula* or *Atrypa reticularis*), upon which they have no room to expand, the maximum length of the colonies is usually less than an inch.

The genus *Hederella*, which, so far as known, is exclusively confined to rocks of Devonian age, was constituted by Professor James Hall in 1884 for the reception of a small group of cyclostomatous polyzoa of the type of *Aulopora Canadensis*, Nicholson. Of the five nominal species now referred to that genus, only two, viz., *H. Canadensis* and *H. filiformis*, have as yet been found in Canada.

In regard to the first of these it may be observed that, after a direct comparison of authentic examples of both, the present writer is convinced that *H. Canadensis* is both generically and specifically identical with the *Stomatopora alternata* of Hall and Whitfield, from the Devonian rocks of Iowa.

The second is a little creeping polyzoon which is abundant in the shales of the Hamilton formation at Thedford and Bartlett's Mills, near Arkona, Ont., and which was identified with the *Aulopora filiformis* of Billings by Professor H. A. Nicholson in 1874. Subsequently, in 1881, Professor Hall, who seems to have taken the correctness of this identification for granted, referred it to his then newly constituted genus *Hederella*, under the name *H. filiformis*. Unfortunately, however, the only description that Billings gave of his species is quite insufficient to enable it to be recognized, and it was not accompanied by any figure. The type and only known specimen of the *Aulopora filiformis* of Billings, which is still preserved in the Museum of the Survey and which is here figured for the first time (on Plate xxix., fig. 1), appears to the writer to be the immature state of a species of *Syringopora* allied to the *S. fascicularis* of Linnæus, from the Wenlock limestone of Dudley and elsewhere. It is so completely silicified that all traces of its internal structure are obliterated, but, although its corallites are at first creeping and form a large-meshed network, they ultimately become erect, though only for a short distance, and are more or less fasciculated. The *Aulopora filiformis* of Nicholson, on the other hand, is unquestionably a *Hederella*, as pointed out by Hall, and if sufficiently distinct from *H. Canadensis*, it will have to be called *H. filiformis*, Nicholson. But, when a large number of specimens of *Hederellæ* are carefully compared, they are found to vary so much in the amount of regularity of their mode of growth and in the degree of slenderness of the colony, that it is often very difficult if not altogether impracticable, to distinguish between *H. Canadensis* and *H. filiformis*. Under these circumstances the writer is inclined to doubt whether the characters which have been relied upon to separate them are either permanent or of specific importance. According to Professor Nicholson, his *A. filiformis* is "a much more robust species" than *H. Canadensis*, "with larger tubes, and much more irregular methods of growth and apertures generally distinctly elevated above the general surface."

PROBOSCINA LAXA. (N. Sp.)

Plate 28, figs. 9, 9a.

Polyzoary creeping, adnate and attached by its whole under surface to some foreign body, spreading laxly and very irregularly branched, usually with numerous short branches proceeding from two or three widely divergent and procumbent tubular axes all of which are subcylindrical in transverse section, rather narrow and slightly swollen opposite the apertures of the cells. Cells entirely immersed, irregular in their disposition, but usually obscurely alternating biserial, the terminal ones subovate in outline: cell apertures not quite terminal, averaging a little less than one half the greatest breadth of the cells, subcircular in outline, with slightly elevated, simple and thin lips. Surface smooth.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect specimen, attached to *Orthis striatula*.

STOMATOPORA MONILIFORMIS. (N. Sp.)

Plate 28, fig. 10.

Polyzoary minute, creeping, attached by the whole of its under surface to some foreign object, very slender and fragile, consisting of a few irregularly disposed but more or less divergent rows of single cells, which, though uniserial, occasionally throw off lateral buds consisting of one or more cells, and which may, as in the specimen figured, proceed from a central or subcentral irregular aggregation of cells. Cells moderately convex, elliptical in marginal outline, averaging half a millimetre in length, about one third longer than broad and placed end to end: apertures of the cells nearly terminal, extremely minute, simple and consisting of mere rounded perforations in the cell wall. Surface smooth.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens each parasitic upon *Orthis striatula.*

This interesting little species is very closely allied to the *Hippothoa devonica* of Œhlert,[*] from the Devonian rocks of the Department of Mayenne, France, and perhaps should be referred to that genus rather than to *Stomatopora.* Its cell apertures are so minute that they can scarcely be seen with an ordinary simple lens, but their characters can be made out without much difficulty under an achromatic microscope with an inch and a half objective.

ASCODICTYON STELLATUM, Nicholson.

Ascodictyon stellatum, Nicholson. 1877. Annals and Mag. Nat. Hist., 4th Ser., vol. XIX, p. 464.

East bank of the Clearwater River, about five miles below the Pembina, Professor Macoun, 1875: two or three specimens, attached to *Orthis striatula.* Hay River, forty miles above its mouth, R. G. McConnell, 1887: one specimen on a worn fragment of shell. Athabasca River, thirty miles below the Red Deer River, and three miles below the Calumet, R. G. McConnell, 1890: five specimens from the first of these localities and four from the second, all attached to *O. striatula.*

The discovery and recognition of this diminutive little species at each of these localities is due to Mr. L. M. Lambe.

PALESCHARA QUADRANGULARIS, Nicholson. (Sp.)

Chætetes quadrangularis, Nicholson. 1874. Geol. Mag., N. Ser., Decade 2, vol. I, p. 58.

Chætetes quadrangularis, Nicholson. 1874. Rep. Palæont. Prov. Ontario, p. 61, fig. 18.

Paleschara quadrangularis, S. A. Miller. 1889. N. Amer. Geol. and Palæont., p. 177 (under *Chætetes*).

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens, one on *Orthis striatula,* one on *Spirifera disjuncta* and two on

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[*] Bulletin de la Société d'Etudes Scientifiques d'Angers, année 1887.

Atrypa reticularis. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one fine specimen, on *Atrypa reticularis.*

MONOTRYPELLA UNJIGA.* (N. Sp.)

Plate 30, figs. 1, 1a-d.

Polyzoary erect, ramose: its terminal branchlets (which are all that happen to be preserved) slender, cylindrical and widely bifurcated, with rounded and slightly expanded apices: surface comparatively smooth, no monticules being developed. Cells polygonal, consisting of autopores only: cell walls thin internally, but much thickened at and near their apertures: transverse diaphragms thin, complete and placed at very irregular intervals.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: a few fragments of the terminal branchlets, averaging ten to twelve millimetres in length and about two mm. in thickness.

CERAMOPORA HURONENSIS, Nicholson.

Ceramopora Huronensis, Nicholson. 1875. Rep. Palæont. Prov. Ont., p. 78, pl. ii, figs. 5, 5a.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a few specimens which are probably referable to this species. One is parasite upon *Orthis striatula*, and the others form four or five small isolated colonies upon a large specimen of *Alveolites vallorum.*

BRACHIOPODA.

CRANIA HAMILTONIÆ, Hall.

Crania Hamiltoniæ, Hall. 1860. Thirteenth Reg. Rep. N. Y. St. Cab. Nat. Hist. p. 77.

Crania Hamiltoniæ, Hall. 1867. Pal. St. N. Y., vol. IV, pt. 1, p. 27, pl. iii., figs. 17-23.

Crania Hamiltoniæ, Nicholson. 1875. Rep. Palæont. Prov. Ont., p. 82.

Hay River, forty miles above its mouth, R. G. McConnell, 1887:

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* The local Indian name for the Peace River.

three specimens, attached to the ventral valve of *Strophodonta demissa*. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: one upper or dorsal valve.

CHONETES LOGANI, var. AURORA, Hall.

Plate 29, figs. 2, 2a.

Chonetes Logani, var. *Aurora*, Hall. 1867. Pal. St. N. Y., vol. IV, pt. 1, p. 137, pl. xxii, figs. 16-28.

Athabasca River, opposite La Saline, Professor Macoun, 1875, and R. G. McConnell, 1890,—also in the first ten miles below the Clearwater, about fifteen or twenty miles farther up, Dr. R. Bell, 1882: a small piece of limestone, from each of these localities, strewn with detached valves of this species, the dorsal valves being better preserved than the ventral. Mackenzie River, at the "Ramparts," six large and unusually well preserved specimens of the ventral valve, one of which is figured, and three of the dorsal: also, on the same river, six miles below "Rock by the river side," a few partially exfoliated valves on a small piece of rock.

As the specimens from these localities appear to present some slight differences from the types of *C. Logani*, var. *Aurora* from New York and Ohio, the former may be characterized as follows:—

Shell rather small, concavo-convex or plano-convex, about one fourth broader than long, transversely semielliptical in marginal outline, cardinal border about equal to or a little less than the greatest breadth of the valves. Ventral valve moderately convex, its umbo broad and somewhat tumid, its beak small, depressed and incurved. On each side of the beak the cardinal edge is armed with three widely divaricating, long and slender spines. When viewed under a lens, the surface of the ventral valve is seen to be marked with numerous minute, but distinct and somewhat flexuous, round and radiating, thread-like raised lines which increase, by bifurcation and intercalation, from about fifty on the umbo to sixty near the front margin. These are crossed by slightly smaller and more close set, but in other respects similar, concentric raised lines (and occasionally also, by a few distant and comparatively coarse concentric wrinkles) in such a way as to produce a minutely nodulous network, though the radiating raised lines are more widely separated than the concentric ones, and the latter are sometimes interrupted, or in some cases dichotomous. Dorsal valve shallowly concave or nearly flat, its outer surface marked by about eight or nine small concentric plications or imbricating lamellæ, with exceedingly minute and close set radiating striæ between them, and its inner surface minutely papillose. Cardinal tooth of the dorsal valve very small and bifid externally. Muscular and vascular impressions not preserved.

Dimensions of the most perfect specimens collected, (the ventral valve figured): length, seven millimetres and a half; breadth, ten mm.

STROPHALOSIA PRODUCTOIDES, Murchison.

Orthis productoides, Murchison. 1840. Bull. Soc. Géol. de France, vol. XI, p. 254, pl. ii, fig. 7.

Leptæna caperata, J. de C. Sby. 1840. Trans. Geol. Soc. Lond., 2nd Ser., vol. V, p. 704, pl. liii, fig. 4, plate liv, fig. 3.

Leptæna caperata, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 58, pl. xxv, fig. 98.

Leptæna laxispina, Phillips. Ib., p. 59, pl. xxv, fig. 99.

Leptæna membranacea, Phillips. Ib., p. 60, pl. xxv, fig. 101.

Productus productoides, DeVerneuil. 1845. Russia and the Ural Mtns., vol. II, p. 283, pl. xviii, fig. 4.

Strophalosia productoides, Davidson. 1865. Brit. Dev. Brachiopoda, p. 97 (which see for a fuller list of synonyms that it has been thought necessary to quote here), pl. xix, figs. 13-21.

Strophalosia productoides, Whiteaves. 1889. This volume, p. 112 (under the heading "Productella (Strophalosia) truncata, Hall"), pl. xvi, figs. 1 and 2.

Athabasca River, first ten miles above the Clearwater, Dr. R. Bell, 1882, nine fine specimens, and opposite La Saline, about fifteen miles further down the river, R. G. McConnell, 1890, three specimens.

PRODUCTELLA DISSIMILIS.

Productus dissimilis, Hall. 1858. Geol. Surv. Iowa, vol. I, pt. 2, p. 497, pl. iii, figs. 7a-e.

Productus dissimilis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 91, pl. xiii, fig. 3. Not *Productus dissimilis*, DeKoninck, 1846.

Productus (*Productella*) *Hallanus*, Walcott. 1884. Pal. Eureka distr. Nev., p. 130, pl. xiii, figs. 17 and 17a.

Athabasca River,—between twenty and thirty miles below the Clear Water, Professor Macoun, 1875, (one specimen),—three miles below the Calumet (three specimens), and thirty miles below the Red River (one specimen), R. G. McConnell, 1890.

PRODUCTELLA SUBACULEATA, var. CATARACTA.

Productella subaculeata, var. *cataracta*, Hall and Whitfield. 1872. 24th Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 198, and (1875) 27th Reg. Rep. do., pl. ix, figs. 9 and 10.

Productella subaculeata, var. *cataracta*, Nettlewroth. 1889. Kentucky Geol. Surv., Kent. Foss. Shells, p. 69, pl. xvii, figs. 5-9.

Mackenzie River, at the "Rock by the river side," R. G. McConnell, 1888: four rather badly preserved but characteristic specimens.

PRODUCTELLA SPINULICOSTA, Hall.

Pl. 29, figs. 3, 3a, and pl. 31, fig. 1.

Productella spinulicosta, Hall. 1857. Tenth Reg. Rep. N. Y. St. Cab., p. 171.
" " " 1867. Pal. N. Y., vol. IV, p. 160, pl. xxiii, figs. 25-37.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: five well preserved and nearly perfect specimens, with some of the long and slender spines entire and in place.

Mackenzie River, at Grand View, forty-four miles below the "Ramparts," R. G. McConnell, 1888: four specimens, one of which is figured on Plate xxxi, in which nearly all the spines are preserved entire, on a small flat piece of argillaceous limestone. It is doubtful, however, whether these are sufficiently distinct from *P. subaculeata*, var. *cataracta.* Professor Hall expressly states that he is "not entirely satisfied" that *P. spinulicosta* is specifically different from his *P. Shumardiana*, and this latter shell is regarded by Mr. Walcott as probably identical with *P. subaculeata.*

PRODUCTELLA LACHRYMOSA, var. LIMA.

Strophomena lima, Conrad. 1842. Journ. Ac. Nat. Sc., Phil., vol. VIII, p. 256.

Productella lachrymosa, var. *lima*, Hall. 1867. Pal. N. Y., vol. IV, p. 174, pl. xxv, figs. 29-32.

Productus (*Productella*) *lachrymosus*, var. *limus*, Walcott. 1884. Pal. Eureka distr. Nevada, p. 132, pl. xiii, figs. 18 and 18a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: a few rather badly preserved specimens, which are essentially similar to two from the Eureka district of Nevada labelled *P. lachrymosa* var. *lima*, by Mr. C. D. Walcott, and kindly forwarded by him for comparison.

Although here referred provisionally to four nominal species, it is most probable that the three last enumerated, if not the whole four, are nothing more than mere local varieties of *P. subaculeata.*

ORTHIS STRIATULA, Schlotheim.

Orthis striatula (Schlotheim). Davidson. 1865. Mon. Brit. Dev. Brach., p. 87, (which see for a full list of the synonyms of this species) pl. xvii, figs. 4-7. Comp. especially with Schnur's figures of *O. striatula* from the Eifel.

Orthis Iowensis, Billings. 1859. In Hind's Rep. Expl. Assinib., Saskatch., &c., p. 187, woodcut, fig. 1a.

" " Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 90, pl. xii, figs. 2 a-h.

Abundant on the east bank of the Clearwater River, five miles below the Pembina, where it was collected by Professor Macoun in 1875 and by Mr. A. S. Cochrane in 1881. Hay River, forty miles above its mouth, R. G. McConnell, 1887: a number of fine specimens. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: four specimens. Athabasca River, three miles below the Calumet and thirty miles below Red River, R. G. McConnell, 1890: apparently common at each of these localities. In Manitoba the same species is said to have been collected at Snake Island, Lake Winnipegosis, by Professor H. Y. Hind, and several fine examples of it were obtained by Prof. Macoun in 1881 on the north shore of the Red Deer River, about half way between Red Deer Lake and Lake Winnipegosis.

Adult specimens of this shell from the Hay River and the "Ramparts" are in some respects intermediate in their characters between the large, broad and compressed form of *O. striatula*, from the Clearwater which Meek described and figured as *O. Iowensis*, and *O. McFarlanei.* They resemble the latter species in the great convexity of their dorsal valves and in the deep marginal sinus of the ventral, but are never so narrowly elongated immediately behind the midlength. Other specimens, again, from the Mackenzie River district, are strikingly similar to the large variety of *O. Tulliensis* of Hall, as figured by Prof. H. S. Williams on Plate 12, fig. 3, of his paper on the "Cuboides Zone and its Fauna."*

In the "American Geologist" for April, 1889, Prof. Williams says that *Orthis Iowensis* is but a western variety of the *O. impressa* of the New York faunas, both of which are but varieties of the European *O. striatula* of Schlotheim, and it is most probable that *O. McFarlanei* is only another local variety of the same species.

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* Bulletin Geol. Soc. America, May, 1890.

The specimens from the Clearwater and other Canadian localities which have been referred to *O. Iowensis* appear to the writer to be practically indistinguishable from *O. striatula*, even as a local variety. At any rate they seem to correspond much better with Schnur's figures of specimens of *O. striatula* from the Eifel, and with Davidson's illustrations of British examples of the same species, than they do with Hall's figures of the types of *O. Iowensis* and its variety *furnarius*.

It is probably this species that was collected by Sir John Richardson in 1825 on the Slave River, forty miles below Lake Athabasca and referred to, on the authority of Mr. J. DeCarle Sowerby,* as a *terebratula* which resembles the *T. resupinata*. Judging by what is known of the geology of this region the shell last named could scarcely be the Liassic fossil now known as *Waldheimia resupinata* but by no means improbably the *Orthis resupinata* (Martin, sp.) of the Carboniferous, the *Terebratula resupinata* of Plate 325 of the "Mineral Conchology," which is regarded by many palæontologists as a variety of *O. striatula*.

STROPHODONTA DEMISSA (Conrad).

Strophomena demissa, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, pt. 2, p. 238, pl. xiv, fig. 14.
Strophomena (*Strophodonta*) *demissa*, Hall. 1857. Tenth Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 137.
Strophodonta demissa, Hall. 1858. Geol. Iowa, vol. I., pt. 2, p. 495, pl. iii, fig. 5.
Strophomena demissa, Billings. 1861. Canad. Journ., N. S., vol. VI, p. 341, figs. 116-118.
Strophomena demissa, Billings. 1863. Geol. Canada, p. 367, figs. 377 a-d.
Strophodonta demissa, Hall. 1867. Pal. N. Y., vol. IV, pp. 81, 101 and 114, pls. xi, xii, xvii and xix.
Strophomena (*Strophodonta*) *demissa*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 87, pl. xiii, figs. 6 a-c.
Strophodonta demissa, Nicholson. 1873. Rep. Palæont. Prov. Ontario, p. 65.
" " Whitfield. 1883. Geol. Wisconsin, vol. IV, p. 327, pl. xxv, fig. 18.
" " Walcott. 1884. Palæont. Eureka distr. Nevada, p. 118, pl. ii, figs. 9 a-b.

Peace River, at Rapid Bouillé, Professor Macoun, 1875: one perfect specimen. Hay River, forty miles above its mouth, R. G. McConnell, 1887: eleven specimens. Peace River, at Vermilion Falls, R. G. McConnell, 1889: three specimens. Athabasca River, three miles below the Calumet, (eight specimens) and thirty miles below the Red River (six specimens), R. G. McConnell, 1890.

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* On page 57 of Appendix No. 1 to Sir John Franklin's "Narrative of a Second Expedition to the shores of the Polar Sea.

STROPHODONTA PERPLANA, Conrad.

Strophomena perplana, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 257, pl. xiv, fig. 11.

Strophomena pluristriata, Conrad. Ib., p. 259.

Strophomena delthyris, Conrad. Ib., p. 258, pl. xiv, fig. 19.

Strophomena crenistria, Hall. 1843. Rep. Fourth Geol. distr. N. Y., p. 171.

" *nervosa*, Hall, Ib., p. 266, fig. 1.

Strophodonta fragilis, Hall. 1857. Fourth Reg. Rep. N. Y. State Cab. Nat. Hist., p. 143.

Strophodonta fragilis, Hall. 1858. Geol. Iowa, vol. I, pt. 2, p. 496, pl. iii, figs. 6 a-c.

Strophomena perplana, Billings. 1861. Canad. Journ., N. S., vol. VI, p. 343.

Strophodonta perplana, Hall. 1867. Pal. N. Y., vol. IV, pp. 92, 98 and 113, pls. xi, xiii, xvii. and xix.

Strophomena perplana, Nicholson. 1873. Pal. Ontario, p. 64, figs. 20a, a.

Strophodonta perplana, Walcott. 1884. Pal. Eureka distr. Nevada, p. 120, pl. xiii, figs. 11.

Strophodonta perplana, var. *Tulliensis*, (?) H. S. Williams. Bull. Geol. Soc. Am., May, 1890, p. 493, pl. xii, figs. 1-4.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: a nearly perfect and well preserved ventral valve, which resembles *S. perplana*, var. *Tulliensis*, in the circumstance that each end of its hinge line is produced into a short spine or mucronate point. It is, however, much larger than the figured type of that variety, and the mucronate points at its cardinal angles are proportionately shorter and not so slender.

Prof. Williams (op. cit., p. 493) says that *S. perplana* "appears to be an American type, and is seen with variations all through our Devonian, but it is not described in the American Devonian." "In the European race" (of the *Strophodonta inæquistriata* type) "as we reach the Cuboides Zone, the terminations of the hinge develop into slender mucronate points." "In the American race" (*S. perplana*) "these mucronate points first appear in the Tully limestone, and are characteristic of the race afterward till it ceases." Mucronate lateral extensions of the hinge line, however, occur in the *Strophomena Leda* of Billings,* from the Silurian rocks at Anticosti, and in an undescribed species of *Strophomena* recently collected by Mr. J. B. Tyrrell from rocks of about the same age on the east side of Lake Winnipegosis, at Cedar Lake and on the Saskatchewan, they are developed into exceedingly long and slender spines.

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* Geol. Surv. Canada. Palæozoic Fossils, vol. I., p. 120, figs. 98, 99.

SPIRIFERA DISJUNCTA, Sowerby.

Plate 29, fig. 4.

Spirifera disjuncta, Sowerby. 1840. Trans. Geol. Soc. Lond., 2nd Ser., vol. V, pl. liii, fig. 8, and pl. liv., figs. 12-13.
" *calcarata*, Sowerby. Ibid., pl. liii, fig. 7.
" *extensa*, Sowerby. Ibid., pl. liv, fig. 11.
" *gigantea*, Sowerby. Ibid., pl. lv, figs. 1-4.
" *inornata*, Sowerby. Ibid., pl. liii, fig. 9.
Spirifera Verneuilii, Murchison. 1840. Bull. Soc. Géol. France, vol. XI, p. 252, pl. ii, fig. 3.
Spirifera disjuncta, Davidson. 1865. Mon. Brit. Dev. Brach., pp. 23 and 24 (which see for a complete list of synonyms of British and European specimens of this series), pl. v, figs. 1-12 and pl. vi, figs. 1-5.
Spirifera disjuncta, Hall. 1867. Pal. N. Y., vol. IV, pls. xli, and xlii, and Walcott, 1884, Pal. Eureka distr. Nevada, p. 134 [which see for list of synonyms of N. American specimens).
Spirifera Kennicotti, Meek. 1860. Trans. Chicago Ac. Sc., vol. I, p. 101, pl. xiv, fig. 9.

Peace River, at Fossil Point, A. R. C. Selwyn, 1875: a few badly preserved specimens.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: abundant and in fine condition. Peace River, at Vermilion Falls, R. G. McConnell, 1889: six specimens.

At these localities, and especially at the latter two, most of the specimens collected belong to the typical form of the species, or at any rate to that which Davidson regarded as such and illustrated under that name on Plate v. of his "Monograph of the British Devonian Brachiopoda." In this form, no matter what the marginal outline of the shell may be, the umbo and beak of the ventral valve are appressed and incurved, while its area, which is concavely arched and nearly vertical, is very narrow in the direction of its height.

As will be seen upon reference to the synonymy quoted, this very variable species was described in 1840 by no less than six different specific names, and it is still doubtful which of these should be retained. Although here called *Spirifera disjuncta*, Sowerby, on account of the very general usage to that effect, especially in American publications, it would seem that the proper name of the species is *S. Verneuilii*, Murchison. In Davidson's monograph (op. cit.), although the species is at first called *S. disjuncta* in the text, yet, in a foot note to page 100, the following very explicit statement is made:—" From having unfortunately overlooked the fact of Murchison's paper in the "Bulletin" having been read twenty three or twenty four days sooner than that of Sowerby, published in the Transactions of the Geological Society, I adopted at page 23 of this Monograph the term *Spirifer disjunctus*, Sow., while that of *S. Verneuilii* has a claim to priority." The Sandbergers, however, (Die Versteinerungen des Rheinischen Schichtensystems in Nassau, p. 320) adopt *Spirifer calcaratus*, J. Sowerby, as the oldest name for this species.

Characteristic specimens of *Spirifera Whitneyi*, Hall (which Professors Hall and Whitfield place as a synonym of the present species, on page 237 of the Twenty-third Reg. Rep. N. Y. Stat. Cab. Nat. Hist., under the heading of *S. Orestes*), were collected by Mr. McConnell in 1885, from limestones apparently of Devonian or Devono-Carboniferous age, in the easternmost range of the Rocky Mountains on the North Saskatchewan.

SPIRIFERA DISJUNCTA, var. OCCIDENTALIS. (N. Var.)

Plate 29, figs. 5 and 5a.

This new varietal name is here proposed for a remarkable local form of *S. disjuncta* (or *S. Verneuilii*), in which the umbonal region and beak of the ventral valve are strongly divergent from those of the dorsal. The beak of the ventral, too, is erect rather than recurved, while its area is broad (in the direction of its height) and flattened almost horizontally.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: four specimens.

SPIRIFERA CYRTINÆFORMIS, Hall and Whitfield.

Spirifera cyrtinæformis, Hall and Whitfield. 1870. Twenty-third Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 238, pl. ii, figs. 21-24.

(?) *Spirifer aperturatus*, Schlotheim, var. *cuspidatus*, D'Archiac and DeVerneuil. 1841. Trans. Geol. Soc. Lond., 2nd Series, vol. VI, p. 369, pl. xxxv, figs. 7 and 7a.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect specimen in a fine state of preservation. This has been compared with authentic examples of S. *cyrtinæformis* from the "marly beds" at Rockford, Iowa, recently received from Professor S. Calvin, and has been found to differ therefrom only in the much larger size and consequently smaller number of its radiating ribs or plications. In the original description of *S. cyrtinæformis* the surface of the valves is said to be "marked by about forty five to fifty low, rounded plications, whereas in the specimen from the Hay River there are only twenty nine or thirty. This difference, however, can scarcely be regarded as of specific importance.

S. cyrtinæformis is very closely allied to the *S. Utahensis* of Meek,* which Mr. Walcott places among the synonyms of *S. disjuncta*. On the other hand, *S. cyrtinæformis* appears to the writer to be specifically identical with the fossil from the Eifel which D'Archiac and DeVerneuil described and figured under the name *S. aperturatus*, var. *cuspidatus*. In his Monograph of the British Devonian Brachiopoda (page 26) Davidson says that *S. aperturatus* is a synonym of *S. canalifera*, Valenciennes (in Lamarck's Hist. Nat. des Animaux sans Vertèbres), but makes no reference to D'Archiac and DeVerneuil's description and figures of *S. aperturatus* and its var. *cuspidatus*. He farther states (op. cit., p. 26) that "*Sp. canalifera* has much of the general shape of *S. disjuncta*, but will be easily distinguished on account of the bifurcation of its lateral ribs, a feature not observable in *S. disjuncta*." According to Prof. Hall, in *S. cyrtinæformis* "the central plication on the mesial fold and sinus divides once or twice before reaching the front of the shell; the other plications are simple."

SPIRIFERA SUBATTENUATA, Hall.

Spirifera indet. Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa and Minnes., pl. iii, fig. 9.

Spirifer submucronatus, Hall. 1858. Geol. Rep. Iowa, vol. I., pt. 2, p. 504 (but as this name was found to be preoccupied it was changed to *S. subattenuata* on p. 3 of the index), pl. iv, figs. 3a, b, c.

Athabasca River,—opposite La Saline, Dr. R. Bell, 1882, a few small specimens,—three miles below the Calumet River, R. G. McConnell, 1890, three specimens,—and thirty miles below Red River, R. G. McConnell, 1890, two specimens.

SPIRIFERA INUTILIS, Hall.

Spirifer inutilis, Hall. 1858. Geol. Rep. Iowa, vol. I, pt. 2, p. 505, pl. iv, figs. 4a, b, c.

Localities, collectors and dates the same as for the preceding species:

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* See Col. Simpson's Rep. Expl. acr. Great Basin of Utah, 1876, p. 345, pl. i, figs. 4, a, b, c, and U. S. Geol. Expl. Fortieth Parallel, vol. IV, 1877, p. 39, pl. iii., figs. 1. 1a-e.

also Pembina River, four miles above its mouth, R. G. McConnell, 1890.

S. inutilis would seem to be nothing more than a mere variety of *S. subattenuata*, in which the hinge area of the ventral valve is proportionately larger and higher, and the cardinal extremities of both valves not nearly so much produced.

SPIRIFERA TULLIA, Hall. VAR.

Plate 32, figs. 1, 1a, b.

Spirifera tullia, Hall. 1867. Pal. St. N. Y., vol. IV, p. 218, pl. xxxv, figs. 1-9.

Shell small, transversely subelliptical or semielliptical, a little broader than long and broadest just behind the midlength: cardinal angles more or less rounded, lateral margins rounding regularly into the front, which is shallowly concave at the termination of the mesial fold and sinus. Ventral valve much more convex than the dorsal, most prominent in the umbonal region, with the sides curving regularly to the margin, but depressed in the centre, its mesial sinus well defined, rounded, very narrow on the beak and umbo, but widening rather rapidly toward the front, where its width slightly exceeds one third of the greatest breadth of the valve: beak small, not very prominent, its apex only being slightly incurved, but not so much so as to cover or overarch any part of the fissure: area moderately high and slightly concave: fissure triangular, higher than wide, with an impressed line or narrow linear groove on each side. Dorsal valve very gently convex, its mesial fold rounded and not much elevated, sometimes with a faint narrow depression in the centre, its hinge line nearly straight and its beak minute and projecting very little above the cardinal margin.

On each side of the mesial fold and sinus there are from seven to nine rounded but somewhat flattened and simple radiating ribs or plications, but there are none on the fold or sinus. In addition to the ribs, the whole surface when examined under a lens is seen to be marked with exceedingly numerous, close-set and minute, but continuous, radiating raised lines, which are crossed by equally minute and nearly as densely crowded concentric raised lines, in such a way as to produce an exquisitely fine network, which is subgranulose at the points of intersection. The radiating raised lines are not always exactly parallel to the ribs, and the concentric ones are regularly arched where they cross over the ribs, fold or sinus.

Dimensions of the specimen figured: length, as measured in the centre, thirteen millimetres and a half; maximum breadth, fifteen mm.; greatest height or depth of the closed valves, nine mm.; width of mesial sinus at the front margin, six mm.

Athabasca River,—first ten miles below the mouth of the Clear Water, Dr. R. Bell, 1882,—and opposite La Saline, twenty-five miles below the mouth of the Clear Water, R. G. McConnell, 1890: one perfect and well preserved specimen from each of these localities.

These seem to represent a mere local variety of *S. tullia*, in which the beak of the ventral valve is much less arched and hooked than it is in the typical form, and the number of ribs or plications on each side of the mesial fold and sinus is much smaller. Prof. H. S. Williams, who has kindly compared both of the specimens from the Athabasca with authentic samples of *S. tullia*, says that, in addition to these differences, the area of the ventral valve in the former is proportionately flatter and higher, and the finer surface striæ are decidedly coarser than in *S. tullia*.

Subgenus MARTINIA, McCoy.

SPIRIFERA (M.) GLABRA, var. FRANKLINI.

Spirifer (*Martinia*) *Franklini*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 107, pl. xiv, figs, 12a-c. For a list of the synonyms of *S glabra*, Martin, see Davidson's Mon. Brit. Carbon. Brach., p. 62.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one rather small but nearly perfect specimen. Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one large and perfect specimen and a detached ventral valve of another.

The specific identity of the *S. Franklini*, Meek, with the *S. glabra* of Martin (the type of McCoy's subgenus *Martinia*) was first suggested by Mr. C. D. Walcott in 1884, in his "Palæontology of the Eureka district of Nevada." On page 139 of that monograph, under the heading *Sp.* (*M.*) *glabra*, Mr. Walcott makes the following remark:—"*Spirifera* (*M.*) *Franklini*, Meek," * * * "is, as mentioned by Mr. Meek, closely related to *S.* (*M.*) *glabra*, and with the original specimen before me to compare with the Nevada shells and Mr. Davidson's figures of the species, it scarcely appears to be more than a variety, if even that, of *S.* (*M.*) *glabra*."

SPIRIFERA (M.) MERISTOIDES, Meek.

Spirifer (*Martinia*) *meristoides*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 106, pl. xiv, figs. 3 a-h.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: twenty-six specimens, most of which are perfect or nearly perfect and in good condition.

On page 142 of the "Palæontology of the Eureka District," Mr. Walcott expresses the opinion that the *S.* (*M.*) *meristoides*, as described and figured by Meek, is identical with the *Athyris Maia* of Billings and the *Spirifera Maia* of Hall. The specimens from the "Ramparts," however, most of which have the appearance of adult shells, are uniformly smaller than the typical *A.* (or *S.*) *Maia*, and show no trace of a mesial fold in the dorsal valve or of a corresponding sinus in the ventral, both of which features are marked characters in full grown examples of Mr. Billings' species.

SPIRIFERA (M.) RICHARDSONI, Meek.

Spirifer (*Martinia*) *Richardsoni*, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 104, pl. xiv, fig. 2.

Athabasca River, opposite La Saline, Dr. R. Bell, 1882: one small specimen, about half the size of the one figured by Meek, but perfect and with the whole of the test preserved. In this specimen, which is obviously immature, the mesial fold and sinus are not developed. Its surface appears to be smooth to the naked eye, but when examined under the lens it is seen to be marked with a few more or less distant concentric striæ, or lines of growth, and with twelve or thirteen faint, rounded and radiating plications. Mr. Walcott (op. cit.,pp. 143 and 144) is inclined to think that *S.* (*M.*) *Richardsoni* is one of the forms of *S. undifera*, Rœmer.

CYRTINA HAMILTONENSIS, Hall.

Cyrtia Hamiltonensis, Hall. 1857. Tenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 166.

Cyrtia Hamiltonensis, Billings. 1861. Canad. Journ., N. Ser., vol. VI, p. 262, figs. 80-82.

Cyrtia Hamiltonensis, Billings. 1863. Geol. Canada, p. 384, figs. 415a-c.

Cyrtina Hamiltonensis, Hall. 1867. Pal. N. Y., vol. IV, p. 268, pl. xxvii, figs. 1-4, and pl. xliv, figs. 26-33, 38-52.
Cyrtina Hamiltonensis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 99, pl. xiv, figs. 5, 7 and 10.
Cyrtina Hamiltonensis, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 83.
" " Walcott. 1884. Pal. Eureka distr. Nevada, p. 147.

Mackenzie River, at the "Ramparts" (two specimens), and ten miles below the "Ramparts" (one specimen), R. G. McConnell, 1888. The species had previously been collected at the "Ramparts," in 1859, by Major Kennicott, and near Fort Good Hope, five miles below the "Ramparts," in 1884, by Mons. l'Abbé Petitot.

Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: a few perfect and well preserved specimens.

CYRTINA BILLINGSI, Meek.

Cyrtina Billingsi, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 97, pl. xiv, fig. 6.

Athabasca River, thirty miles below Red River, R. G. McConnell, 1890: one fine and perfect large specimen, and a similar but much smaller one.

ATHYRIS ANGELICA, var. OCCIDENTALIS.

Plate 32, figs. 3, 3a, b.

Athyris Angelica, Hall. 1861. Fourteenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 99.
Athyris Angelica, Hall. 1867. Pal. N. Y., vol. IV, p. 292, pl. xlvii, figs. 9-20.

Shell like the type of *A. Angelica*, but much smaller and more distinctly biplicated. Ventral valve with two widely divergent rounded and prominent plications, which extend to the beak, with a shallow sinus between them. Dorsal valve with a broad flattened mesial fold and a narrow divergent one on each side. The surface markings seem to consist of concentric striations only, no trace of any radiating lines being visible even under a lens. In average examples the greatest breadth is about half an inch and the maximum length a little less. The largest specimen collected, a detached ventral valve, is 15.5 mm. (or about five eighths of an inch) in its greatest breadth and 13.5 mm.

in length. The specimens of O. *Angelica* figured by Professor Hall are from a little less than three quarters to fully one inch in breadth.

Athabasca River, first ten miles below the Clear Water, and opposite La Saline, about fifteen miles farther down the river, Dr. R. Bell, 1882: four good specimens from the first of these localities and seven from the second.

ATHYRIS PARVULA. (N. Sp.)

Plate 32, figs. 4, 5 and 5a.

Shell very small for the genus, moderately convex, varying in lateral outline from transversely subelliptical to subcircular or longitudinally and broadly subovate, in some specimens a little broader than long, in others the reverse: anterior margin distinctly sinuated. Ventral valve more convex than the dorsal, its front margin depressed in the centre in such a way as to form a regularly concave mesial sinus which becomes obsolete at or near the midlength, its umbo prominent, tumid and rather broad, and its incurved beak truncated almost vertically and perforated with a circular foramen. Dorsal valve with a moderately elevated, rounded mesial fold on and near the front margin, its beak being small, narrow and not very prominent.

Surface marked with regularly disposed, nearly equidistant and somewhat imbricating, concentric striations. Characters of the interior of the valve unknown.

The largest specimen collected, a detached ventral valve, is nine millimetres and a half in length, and ten mm. in its greatest breadth. The dimensions of two other perfect specimens are as follows:—No. 1, (fig. 4) maximum length, nine mm.; greatest breadth, nine mm. and a half (9.5); maximum thickness, six mm.; No. 2, (figs. 5 and 5a) length, eight mm. and a quarter (8.25); breadth, eight mm.; thickness, five mm. and a half (5.5.)

Athabasca River, three miles below the Calumet (five good specimens) and thirty miles below Red River (one perfect specimen), R. G. McConnell, 1890.

This diminutive little species seems to be more nearly related to the *Athyris vittata* of Hall than to the *S. spiriferoides* of Eaton, though it may prove to be only a local diminutive race of the latter. As compared with a series of authentic examples of *A. vittata*, from two localities in Iowa, recently forwarded by Prof. S. Calvin, the specimens collected by Mr. McConnell differ therefrom, not only in their much smaller size, but also in the fact that their front margins are much more distinctly sinuated. From Ohio specimens of *A. vittata*, such as those described and figured by Prof. Hall, the specimens from the Athabasca differ also in their much smaller size and in the circumstance that the mesial fold and sinus of each are more rounded and do not extend nearly as far backward.

ATRYPA RETICULARIS, L.

For a complete list of synonyms of this species see Davidson's "Monograph of the British Devonian Brachiopoda, page 53, the same authors "British Silurian Brachiopoda," p. 129, or Hall's Palæontology of the State of New York, vol. IV, pt. 1, p. 316.

Peace River, at Vermilion Falls, R. G. McConnell, 1889. Athabasca River, from the mouth of the Clear Water to about twenty five miles below that stream, and thirty miles below Red River; A. S. Cochrane, 1881, Dr. R. Bell, 1882, and R. G. McConnell, 1890. East side of Clear Water River, five miles below the Pembina, Prof. Macoun, 1875. Hay River, forty miles above its mouth, R. G. McConnell, 1887. Mackenzie River, at the "Ramparts," and at Grand View, forty four miles below the "Ramparts," R. G. McConnell, 1888. Apparently abundant at each of these localities. The species had previously been collected by Messrs. Kennicott and Macfarlane on the Mackenzie River at the "Ramparts" and near Fort Good Hope.

ATRYPA RETICULARIS, var. ASPERA.

Terebratula aspera, Schlotheim. 1820. Petrefact., p. 263, t. xviii, fig. 3.
Atrypa aspera, Dalman. 1827. Vet. Akad. Handl., t. iv, fig. 3.
Atrypa reticularis, var. *aspera*, Davidson. 1864. Brit. Dev. Brach., p. 57 (which see for a full list of synonyms of this shell), pl. x, figs. 5-8.
Atrypa aspera, var. *occidentalis*, Hall. 1858. Geol. Iowa, vol. I, pt. 2, p. 515, pl. vi, figs. 3a, b, c, d.
Atrypa spinosa, Hall. 1843. Geol. Rep. Fourth Distr. N. Y., p. 200, figs. 1 and 2.
Atrypa dumosa, Hall. Ibid., p. 271, fig. 1.
Atrypa spinosa, vel. *A. aspera*, Hall. 1867. Pal. N. Y., vol. IV, pt. 1, p. 322, pl. liii.A, figs. 1-14, 18, 24 and 25.
Atrypa aspera, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 96, pl. xiii, fig. 12.

Peace River, at Vermilion Falls, R. G. McConnell, 1889. Athabasca

River, first ten miles below the Clear Water, Dr. R. Bell, 1882; three miles below the Calumet and thirty miles below Red River, R. G. McConnell, 1890. Pembina River, four miles above its mouth, R. G. McConnell, 1890. Hay River, forty miles above its mouth, R. G. McConnell, 1887. Mackenzie River, at the "Ramparts," and ten miles below the "Ramparts," R. G. McConnell, 1888; apparently as common as the typical form at each of these localities. The occurrence of this shell at the Ramparts and Fort Good Hope had previously been recorded by Meek, and an unusually large and fine specimen of it, which is now in the Survey collection, was collected by l'Abbé Petitôt in 1874 near Fort Good Hope.

In the typical *A. reticularis* the radiating ribs are very fine and numerous, so much so that in a large and well preserved specimen of it from the Hay River, as many as 180 of them can be counted on the front margin of the shell. According to Professor Hall, in the Iowa shells for which he proposed the name *A. aspera*, var. *occidentalis*, the surface is "marked by ten or twelve dichotomizing plications upon each valve," so that there would not be much more than twice those numbers on their front margins. Professor Hall, however, states that in this western variety "the number of plications is only about half as many as in full grown specimens of the species in the shales of the Hamilton group of New York."

The reasons which induced Dr. Davidson to concur with Hisinger, Lindström, Brown and McCoy in regarding the *A. aspera* of Schlotheim as a mere variety of *A. reticularis*, are fully stated on page 57 of the "British Devonian Brachiopoda." The numerous and perfect specimens collected by Mr. McConnell on the Peace, Hay and Mackenzie Rivers would seem to support this conclusion, as most of them are intermediate in their characters between *A. reticularis* proper and *A. aspera*. The greater number of them, too, correspond much better with Hall's descriptions and figures of the eastern shell which he has called *A. spinosa* than with the western form of *A. aspera*, and in several specimens from the Hay River the comparatively fine radiating ribs are distinctly spinose.

RHYNCHONELLA PUGNUS, Martin.

Conchyliolithus anomites pugnus, Martin. 1809. Petref. Derb., tab. xxii, figs. 4, 5.
Atrypa pugnus, Sowerby. 1840. Geol. Trans., 2nd Ser., vol. v, pl. lvi, figs. 15-18.
Terebratula pugnus, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 87, pl. xxxv, figs. 156 a-e.
Terebratula anisodonta, Phillips. 1841. Ib., p. 86, pl. xxxiv, figs. 154 a-c.

Rhynchonella pugnus, Davidson. 1861. Mon. Brit. Carb. Brach., p. 47, pl. xxii, figs. 1-15. Ib. Mon. Brit. Dev. Brach., 1865, p. 63, pl. xii, figs. 12-14, pl. xiii, figs. 8-10.
Rhynchonella Missouriensis, Meek. 1866. Geol. Surv. Illinois, vol. II, p. 153, pl. xiv, figs. 4a, b. Fig. 5a of pl. C, 2nd Ann. Rep. Geol. Surv. Missouri, 1855, is also referable to *R. pugnus*, as stated by Mr. Meek. Not *R. Missouriensis*, Meek, 1868, ib., vol. III, p. 450, pl. xiv, figs. 7a-d.
Rhynchonella alta, Calvin. 1877. Paper read before the Iowa Ac. Sc. and a named photographed plate distributed.
Rhynchonella pugnus, Williams. 1883. Am. Journ. Sc., vol. XXV, p. 99.
" " Walcott. 1884. Pal. Eurek. Distr. Nev., p. 155 (from which this list of synonyms is quoted), pl. xiv, figs. 7, 7a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one perfect specimen. Athabasca River, three miles below the Calumet, R. G. McConnell, 1890: two small specimens.

The small *Rhynchonella* referred to on page No. 100 of the Report of Progress of the Geological Survey of Canada for 1875-76 as having been collected by Dr. Selwyn in 1875 at Fossil Point on the Peace River, is probably a variety of *R. pugnus*.

RHYNCHONELLA CUBOIDES, Sowerby.

Atrypa cuboides, Sowerby. 1840. Trans. Geol. Soc., Ser. 2, vol. V, pl. vi, fig. 24.
" *crenulata*, Sowerby. 1840. Ibid., fig. 17.
" *impleta*, Sowerby. 1840. Ibid., pl. lvii, fig. 2.
Terebratula cuboides, DeKoninck. Anim. foss. de Belgique, p. 285, tab. 19, fig. 3.
" " Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 84, pl. xxxiv, fig. 150.
Terebratula crenulata, Phillips. 1841. Ibid., p. 85, pl. xxxiv, fig. 152.
Atrypa cuboides, Vanuxem. 1842. Geol. Rep. Third Distr. N. Y., p. 163, fig. 1.
" " Hall. 1843. Geol. Rep. Fourth Distr. N. Y., pp. 215 and 216, fig. 1.
Rhynchonella venustula, Hall. 1857. Pal. N. Y., vol. IV, p. 346, pl. liv.A, figs. 24-43.
Rhynchonella Emmonsi, Hall and Whitfield. 1877. Geol. Expl. 40th Par., vol. IV, p. 247, pl. iii, figs. 4-8.
Rhynchonella intermedia, Barris. 1878. Proc. Davenport Ac. Nat. Sc., vol. II, p. 285, pl. xi, figs. 5-6.
Rhynchonella Emmonsi, Walcott. 1884. Pal. Eureka Distr. Nev., p. 157.
Rhynchonella cuboides and *R. venustula*, H. S. Williams. 1890. Bullet. Geol. Soc. America, p. 493, pl. xiii.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: one perfect but not very well preserved specimen. Peace River, at Vermilion Falls, R. G. McConnell, 1889: two perfect but partially exfoliated specimens. The one from the Hay River has eleven rounded and undivided ribs on the mesial sinus, at the front margin, ten similar ones on the fold, and fourteen or fifteen flattened ribs on each side. In the larger of the two specimens from the Peace River there are eleven flat ribs on the sinus, ten rounded ones on the central fold, and eighteen to twenty on each side.

The rather coarsely ribbed variety of the species from the State of New York to which Hall subsequently gave the name *Rhynchonella venustula*, was originally identified by Conrad and Vanuxem with the *Atrypa cuboides* of Sowerby. Under the heading of *Rhynchonella Emmonsi*, also, Mr. C. D. Walcott remarks:—"There is very little doubt but that *R. intermedia*, *R. Emmonsi* and *R. venustula* are varieties of *R. cuboides*." The three specimens collected by Mr. McConnell are doubtless conspecific with the Nevada shell which has been called *R. Emmonsi*, but they also appear to the writer to be quite indistinguishable from the *R. venustula* as figured by Prof. Williams (op. cit., pl. xiii, figs. 4 and 8), from some of the specimens of *R. cuboides* figured by the same author, and from the coarsely ribbed forms of *R. cuboides* (var. *impleta*), illustrated by Davidson on plate xiii, figs. 20 and 21, of his Monograph of British Devonian Brachiopoda. Prof. Williams (op. cit., pp. 493-94) says that "*R. venustula*, Hall, is by common consent closely allied to *R. cuboides* of Europe, the chief distinction lying in the number of plications in the median fold and sinus which are less than in the prevailing type of the European *cuboides*." Yet, in one of the specimens of *R. venustula* figured by Professor Hall (op. cit. fig. 43) there are as many as ten radiating ribs in the mesial sinus of the ventral valve.

RHYNCHONELLA CASTANEA, Meek.

Rhynchonella castanea, Meek. 1868. Trans. Chicago Ac., Sc., vol. I, p. 93, pl. xiii, figs. 9 a-c.

Rhynchonella castanea, Walcott. 1884. Pal. Eureka Distr. Nev., p. 153, pl. xv, figs. 1, 1a, 4 and 4a.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one perfect specimen.

EATONIA VARIABILIS. (N. Sp.)

Plate 29, figs. 6, 6a, 7, 8, 8a and 9.

Shell compressed biconvex, the thickness through the closed valves varying in different specimens from a little more to a little less than one half of their greatest breadth, transversely subelliptical, a little broader than long: front margin truncated in the centre in some specimens (as in fig. 6), regularly rounded in others (as in fig. 7), and in some (as in fig. 8), produced into a short rounded lobe. Ventral valve moderately convex on the umbo, immediately below or in front of which there is a more or less well defined mesial sinus, which widens rapidly forward and outward. Beak of the ventral valve small, projecting very little beyond that of the dorsal, slightly incurved, truncated and perforated by a minute subcircular foramen, underneath which there is a very small deltidium. Dorsal valve differing little from the ventral in contour, except that it has a mesial fold instead of sinus, and a smaller and entire beak.

The finer surface markings are very imperfectly preserved, nearly the whole of the outer layer of the test of the specimens collected being exfoliated. Both of the valves, however, are marked with radiating plications, which vary in shape, number and disposition in different individuals. Thus, in the specimen represented by fig. 6 there are three strongly developed subangular plications in the ventral valve, one in the centre of the sinus and one forming each of its outer limits, and four on the dorsal, i.e., two on the mesial fold and one on each side of it. All of these plications, in this as in other specimens, are obsolete on the umbo of each valve, and most prominent around the front margin. In the original of fig. 7 the two plications on the mesial fold of the dorsal valve trifurcate before reaching the front margin, and there is a very short marginal fold intercalated between them. There are three faint but continuous plications on each side of the fold and sinus, so that round the front margin of this specimen as many as thirteen plications can be counted on the dorsal valve, and there are eleven on the ventral. Lastly, in yet another specimen (fig. 8) there are two rather broad, rounded and continuous plications on the mesial fold of the dorsal, and three in the sinus of the ventral (one in its centre and one forming each of its outer boundaries), but there are no lateral plications. Upon the only specimen in which any portion of the outer layer of the test is preserved, the surface of the latter is seen to be marked by narrow radiating raised lines of very small but unequal size, which are crossed by narrower concentric raised lines, the latter being very closely and regularly disposed, as well as slightly undulating when viewed with a lens.

Characters of the interior unknown, though in some specimens there are indications of a mesial septum in the dorsal valve, which appears to have extended from the beaks about half-way to the front margin.

The dimensions of the three specimens figured are as follows:—The one represented by fig. 6, length, twelve millimetres; breadth, fourteen mm. and a half; thickness, six mm. and a half: by fig. 7, length, eleven mm. and a half; breadth, fifteen mm.; thickness, four mm., and a half: and by fig. 8, length, fifteen mm.; breadth, sixteen mm.; and thickness, nine.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: fifteen separate specimens and a small piece of rock consisting of an agglomeration of many others.

As the characters of the interior of the valves are unknown, it is of course doubtful to what genus this species should be referred. It is here provisionally regarded as an *Eatonia* on account of the strong resemblance that the specimens bear externally to some forms of the *E. medialis* of the Lower Helderberg limestone of the State of New York, of which it is just possible that they may prove to be a dwarf variety.

PENTAMERUS GALEATUS, Dalman. Var.

Plate 30, fig. 2.

Atrypa galeata, Dalman. 1827. Konigl. Vetens. Acad. Handlingar, p. 130.
Pentamerus galeatus, Davidson. 1865. Mon. Brit. Silur. Brach., p. 145 (which see for a full list of synonyms of this species up to date), pl. xv, figs. 13-23.
Pentamerus galeatus, Zittel. 1883. Handbuch der Palæont., vol. I, p. 603, fig. 534.

Mackenzie River, at the "Ramparts" R. G. McConnell, 1888: a single and apparently somewhat immature specimen, which, however, is strikingly similar to the Devonian variety of *P. galeatus*, from Gerolstein on the Eifel, figured by Zittel in the volume cited above. It differs from *P. comis*, Owen (which is possibly only another variety of *P. galeatus*), principally in the greatly produced umbo and strongly recurved beak of its ventral valve. The shallow mesial sinus in the front of its dorsal valve is bent abruptly inward at almost a right angle to the rest of the valve and bears a single faint plication in the middle, while the feebly developed mesial fold in its ventral valve is biplicated near the front, where the two folds are divided by a short groove. On each side of the mesial fold and sinus there are two or three very faint and short marginal plications.

In Europe *P. galeatus* has long been recognized as a Devonian as well as a Silurian fossil, but it does not seem to have been previously recorded as occurring in the Devonian rocks of North America.

STRINGOCEPHALUS BURTINI, Defrance.

Plate 29, figs. 10, 10a, 11 and 11a.

Stringocephalus Burtini, Defrance. 1827. Dict. des Sc. Nat., vol. LI, p. 102, et Atlas, pl. lxxv, figs, 1, 1a.
Terebratula porrecta, Sowerby. 1827. Min. Conch., pl. 576, fig. 1.
Stringocephalus Burtini, Davidson. 1865. Mon. Brit. Devon. Brach., p. 11 (which see for a complete list of synonyms of the species), pl. i, figs. 18-22, and pl. ii, figs. 1-11.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: two casts of the interior of the closed valves, both of which are figured.

One of these (figs. 10, 10a) is of the normal shape and of moderate convexity. Its dimensions are:—length, not quite two inches and three quarters; breadth, a little over two inches and three quarters; thickness through the closed valves, exclusive of the test, about one inch and three quarters. The dorsal valve is somewhat more convex than the ventral, the thickness through the closed valves is much less than their breadth or height, and the umbo and beak of the ventral are prominent and nearly straight. The other (figs. 11 and 11a) which is somewhat distorted, represents an unusually globose form of the species, with the umbo of the ventral valve depressed and its beak closely recurved over that of the dorsal. The approximate dimensions of this specimen are:—length, two inches and a half, breadth, not quite as great; thickness through the closed valves, exclusive of the test, which is not preserved, two inches and a quarter. The test of this specimen seems to have been thick, judging by portions of it that are left in the matrix from which the cast figured was broken.

CRYPTONELLA CALVINI (?) Hall and Whitfield.

Cryptonella Calvini, Hall and Whitfield. 1870. Twenty-third Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 239.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888, a few small specimens in a piece of limestone; and Peace River, at Vermilion Falls, R. G. McConnell, 1889, one adult and nearly perfect specimen, all of which are probably referable to this species. The only adult specimen is certainly "much less ventricose than *C. Eudora*" of the Chemung sandstones of the State of New York, and approaches more nearly in lateral outline to *C. planirostrata.* Its dorsal valve is much flatter than the ventral, and its greatest breadth is, if anything, rather behind than in front of the midlength.

NEWBERRIA, Hall. (Gen. Nov.)

"Diagnosis.—Shells elongate-ovoid, having the general contour and external aspect of RENSSELÆRIA and AMPHIGENIA, but without the strongly radiate-striate surface of the former genus. The convexity of the valves is greatest in the umbonal region, and the surface is distinctly flattened over the lateral slopes, leaving the median portion of the valves very prominent.

The pedicle-valve has the rostrum produced and incurved; the apex truncated by a circular foramen; deltidial plates not determined. The teeth are comparatively small, projecting forward and gently upward, free at their extremities, and supported by narrow dental plates, which join the interior of the valve above the middle of its depth and are continued forward as slender ridges upon the inner surface, which gradually merge into the shell.

In the bottom of the rostral and umbonal cavity there is a broad, scarcely defined muscular area, from which radiate a series of vascular ridges and depressions: the strongly marked pair of diductors are situated posteriorly, just within this muscular area; lying in front of these is a single (rarely subdivided) elongate adductor impression which often extends forwards to the centre of the shell.

On each side of the muscular impressions is a thickened triangular area, very narrow at its origin in the umbonal region, widening anteriorly and produced into two divergent furrows (four in all) which extend over the pallial region in some instances almost to the anterior margin.

In the brachial valve there are two short divergent crural plates, which are not united at their bases to form a hinge plate as in RENSSELÆRIA. A low median ridge arises between them, passing for a short distance along the bottom of the valve, separating the obovate narrowly flabelliform muscular scars of the adductor muscles. These scars are characterized by the strong striation of their surfaces.

Surface smooth or with obscure radiating striæ.

Shell substance punctate. (?)

Dedicated to John S. Newberry, M.D., LL.D., Professor of Geology and Palæontology in the School of Mines, Columbia College, New York, and lately State Geologist of Ohio, as a mark of appreciation of his high scientific attainments, and in remembrance of a friendship which has continued uninterrupted during fifty years.

Type: *Rensselæria Johanni*, Hall.

Observations.—Several species of RENSSELÆRIA have an essentially similar form, but they are always marked by strong radiating striæ, which, as far as observed, are obscure, or visible in specimens of NEWBERRIA only in partial exfoliation of the surface, very much as they appear in AMPHIGENIA. On the interior of the pedicle valve RENSSELÆRIA preserves two broad, strong, dental plates which reach nearly to the bottom of the rostral and post-umbonal cavity, leaving a narrow space for the muscular area, quite unlike that of the corresponding valve of NEWBERRIA. It is from this narrow cavity, produced by the encroachment of these strong dental plates, that we have the narrow elongate rostral casts of RENSSELÆRIA, which are very dissimilar to those of NEWBERRIA.

In the brachial valve the thickened strong hinge plate of RENSSELÆRIA which supports the crura, does not exist in species of NEWBERRIA, and in the latter genus we have no knowledge, thus far, of the existence of any interior loop or plate, as in RENSSELÆRIA. The external form and surface characters of NEWBERRIA are very similar to those of AMPHIGENIA, but the interior of the latter shell carries a spondylium or spoon-shaped process, an organ not present in NEWBERRIA nor in RENSSELÆRIA.

Species of NEWBERRIA are known to occur in the Devonian rocks near Davenport, Iowa; in Manitou county, Missouri; and on the Mackenzie River."

(Professor James Hall, communicated in a letter dated February 5, 1891.)

NEWBERRIA LÆVIS, Meek. (Sp.)

Plate 30, figs. 3, 4 and 4a.

Rensselæria lævis, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 108, pl. xiii, fig. 8, and pl. xiv, fig. 4.

Not *Rensselæria lævis*, Hall. 1859. Pal. St. N. Y., vol. III, p. 256, pl. xl, figs. 2 a-b.

Mackenzie River, at the "Ramparts," and ten miles below the Ramparts, R. G. McConnell, 1888: several nearly perfect specimens with the test preserved, the largest of which is fully two inches and three quarters in length, and a single cast of the interior of both valves, the original of fig. 3. These have been examined and critically studied by Professor Hall, and are here placed in the genus *Newberria* entirely on his authority.

PELECYPODA.

PTERINOPECTEN. (Sp. undt.)

Athabasca River, ten miles below the mouth of the Clear Water, Dr. R. Bell, 1882, two specimens, and R. G. McConnell, 1890, three specimens, all of which are too imperfect to be identified or described.

PTERINEA FLABELLUM, Conrad.

Avicula flabella, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 238, pl. xii, fig. 8.
" " Vanuxem. 1843. Geol. Surv. N. Y., Rep. Third Distr.
Pterinea flabella, Hall. 1884. Pal. St. N. Y., vol. V, pt. 1, p. 93, pl. xiv, figs. 1-21, pl. xv, figs. 1, 4-6, 8-10, and pl. lxxxiii, figs. 11, 12.
Comp. *Pterinea fasciculata*, Goldfuss. 1840. Petref. German., p. 137, pl. cxx, fig. 5.
Pterinea fasciculata, Drs. G. and F. Sandberger. 1856. Verstein. Rhein. Schichtensyst. Nassau, p. 293, pl. xxx, fig. 7.
Pterinea costulata, F. A. Ræmer. Dunker and Von Meyer, Palæontographica, Bd. ii, S. 3, Taf. 1, fig. 3.

Peace River, at Vermilion Falls, R. G. McConnell, 1889: two nearly perfect and well preserved left valves.

It seems to be doubtful whether *P. flabellum* is identical with the *P. fasciculata* of Goldfuss or not. In his first and second report as palæontologist to the State of New York, Conrad himself quotes *P. fasciculata* as one of the fossils of that state, though in his subsequent description of *Avicula flabella* he makes no reference whatever to its resemblance to Goldfuss' species. On page 293 of their monograph of the fossils of the Devonian rocks of Nassau, the Sandbergers place *P. flabellum*, of which they state that they have received an original example (" original exemplar") from the Hamilton Group of the State of New York, from Hitchcock, — among the synonyms of *P. fasciculata*.

ACTINOPTERIA BOYDII, Conrad. (Sp.)

Avicula Boydii, Conrad. 1842. Jour. Ac. Nat. Sc. Phil., vol. VIII, p. 237, pl. xii, fig. 4.
Avicula quadrula, Conrad. 1842. Ib., p. 243, pl. xiii, fig. 5.
Pterinea Boydii, Conrad. S. A. Miller. 1877, in Cat. Am. Pal. Foss., p. 201.
Actinopteria Boydi, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, p. 113, pl. xix, fig. 2-24, 26-30, and pl. lxxxiv, figs. 16 and 17.

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: one imperfect but well preserved and characteristic left valve.

PTYCHOPTERIA ÆQUIVALVIS. (N. Sp.)

Plate 32, figs. 6 and 6a.

Shell of medium size, equivalve, rather strongly convex in the umbonal region, the umbonal convexity in each valve extending to the anterior end of the base, abruptly inflected into the anterior wing and narrowing much more gradually into the posterior alation: greatest thickness a little more than half the maximum length. Height and length very nearly equal, the greatest length being at the hinge line, whence the valves narrow downwards to the somewhat pointed basal margin, which is narrowly rounded on its anterior side but much more broadly convex posteriorly. Anterior wing comparatively large and distinctly angulated at its outer extremity: posterior wing about twice as long as the anterior, not separated from the central portion of the valves by any alar groove or plication, but consisting of a mere upward expansion of the post-umbonal slope, its outer termination nearly rectangular but very slightly produced. Cardinal area very narrowly pyriform in front of the beaks and linear lanceolate behind them. Umbones prominent, rather broad, and placed a little in advance of the midlength, beaks curved inward, downward and a little forward.

Surface marked by extremely numerous and minute radiating impressed lines or narrow grooves. On the umbonal region and posterior wing some of these grooves are comparatively coarse and distant, with much finer ones intercalated between them, but on the anterior wing all the radiating grooves are of nearly uniform size and very closely disposed. On the anterior wing also the radiating grooves are crossed by very minute but distinct and close set concentric raised lines, which are absent on the umbonal region or central portion of the valves and very feebly developed on the posterior wing.

Dimensions of the only specimen collected, maximum length, estimated at twenty seven millimetres; greatest height, twenty five mm.; maximum thickness through the closed valves, a little over sixteen mm. (16.3 mm.)

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: one nearly perfect and well preserved specimen, with both valves.

This species would seem to be a very aberrant member of the genus *Ptychopteria*, for its shell is equivalve and its posterior wing is devoid of any longitudinal fold or groove and merges imperceptibly into the umbonal convexity.

It appears to be most nearly related to the *P. expansa* of Hall,* from the Chemung Group of Pennsylvania, but its beaks are more nearly central, its posterior wing is not nearly so much produced above, and the surface markings of the two species are quite different.

LEPTODESMA DEMUS, Hall. (Var.)

Plate 32, fig. 7.

Leptodesma Demus, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 1, p. 203, pl. xc, figs. 15 and 16.

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: a perfect left valve which is almost exactly similar in shape to the right valve of *L. Demus* figured by Hall (op. cit., pl. xc, fig. 15), except that its basal margin is not quite so narrowly rounded.

The types of *L. Demus* are stated to be from the Chemung Group of Lawrenceville, Tioga Co., Pa.

LEPTODESMA JASON, Hall.

Plate 32, fig. 8.

Leptodesma Jason, Hall. 1884. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 1, p. 213, pl. xci, figs. 4-6.

Athabasca River, opposite La Saline, R. G. McConnell, 1890: a few good specimens, one of which has both of the valves preserved.

The types of *L. Jason* are also stated to be from the Chemung Group of Pennsylvania.

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* Pal. State N. York, vol. V, pt. 1, Lamellibr., 1, (1884), p. 152, pl. xxiii, figs. 10 and 11.

PALÆONEILO. (Sp. Undt.)

Athabasca River, first ten miles below the mouth of the Clearwater, Dr. R. Bell, 1882: a cast of the interior of the closed valves of a narrowly elongated species of this genus, shewing impressions of numerous cardinal teeth.

The specimen is much too imperfect to be identified, but it seems to have been very similar in shape to the *P. attenuata* of Hall,* from the Waverly Group of Ohio.

PARACYCLAS ELLIPTICA, Hall.

Paracyclas elliptica, Hall. 1843. Geol. Surv. N. Y., Rep. Fourth Distr., p. 171, t. 67, fig. 2.

Lucina elliptica, Billings. 1859. Hind's Rep. Assinib. and Saskatch. Expl. Exp., p. 187, fig. 1d.

Lucina (*Paracyclas*) *elliptica*, Hall, var. *occidentalis*, Hall and Whitfield. 1872. Twenty fourth Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 189.

Paracyclas elliptica, Hall. 1885. Pal. N. Y., vol. V, pt. 1, Lamellibr., pt. 2, p. 440, pl. lxxvii, figs. 23-33, and pl. xcv, fig. 18.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: three specimens. Mackenzie River, at the "Ramparts," (five specimens), and ten miles below Bear River (one specimen); R. G. McConnell, 1888.

All the specimens collected are more or less well preserved casts of the interior of the closed valves. Those from the Mackenzie River belong to the large and rather inflated form of the species which Professor Hall once separated as the variety *occidentalis*, but specimens precisely similar to these are abundant in the Corniferous limestone of Ontario. The specimens from the Hay River are quite small.

SCHIZODUS CHEMUNGENSIS, Conrad.

Plate 30, figs. 5, 5a.

Nuculites Chemungensis, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 247, pl. xiii, fig. 13.

Schizodus Chemungensis (Conrad) Hall. 1870. Prelim. Not. Lamellibr., 2, p. 96.

" " " " 1885. Pal. N. Y., vol. V, pt. 1, Lamellibr., pt. 2, p. 453, pl. lxxv, figs. 37-40, 45, 41.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a cast of the interior of both valves, which very closely resembles the specimen of this species figured by Prof. Hall on plate lxxv, fig. 45, of volume five, part 1 (Lamellibranchiata,) of the Palæontology of the State of New York.

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* See Pal. St. N. York, vol. V, pt. 1, Lamellibr., ii, 1885, p. 346, pl. l, figs. 34-39.

GASTEROPODA.

EUOMPHALUS (STRAPAROLLUS) INOPS, Hall.

Plate 31, fig. 3 and 3a.

Euomphalus inops, Hall. 1876. Illustr. Devon. Foss., Gasterop., pl. 16.
Euomphalus (*Straparollus*) *inops*, Hall. 1879. Pal. N. Y., vol. V, pt. 2, p. 58, pl. xvi, fig. 5.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: three specimens which agree remarkably well with the description and figure of the *E. inops* of Hall, from the Schoharie Grit of the State of New York, especially in the peculiar concavity of the unbilical area, though it must be born in mind that Prof. Hall's species was based upon a single imperfect cast of the interior of the shell and that its characters therefore are very imperfectly understood.

EUOMPHALUS (STRAPAROLLUS) FLEXISTRIATUS. (N. Sp.)

Plate 31, figs. 2 and 2a.

Shell small, discoidal, spire depressed below the highest level of the outer volution. Volutions rather slender, coiled on nearly the same plane, contiguous and increasing gradually in size, their number uncertain, as nearly the whole of the inner ones are broken off in the only specimen collected, but probably, when entire, about three or four; outer volution compressed above and below and narrowly rounded on the periphery; umbilicus occupying nearly one-third of the entire diameter of the base; aperture transversely elliptical, its lower portion occupying a little more than one third of the entire basal diameter.

Surface marked by simple and flexuous transverse striæ of growth. On the base of the only specimen collected, commencing at the umbilical margin, these striæ at first curve gently and concavely backward, then obliquely forward and outward until they reach the centre of the periphery, after which their course cannot be traced, as they are not preserved on the upper side.

Maximum diameter, twenty three millimetres; width of umbilicus (as measured on the suture), eight mm.; longest diameter of aperture, nine mm.

Mackenzie River, at the "Ramparts," R. G. McConnell, 1888: one specimen.

This little shell seems to differ from the *Euomphalus inops*, *E. rudis* and *E. Hecale* of Hall in its depressed spire, and from the *E. clymenioides* of Hall (which is identical with the *Straparollus Canadensis* of Billings) in its smaller size, much less slender whorls and consequently narrower umbilicus.

EUOMPHALUS MASKUSI.* (N. Sp.)

Plate 31, fig. 4.

Shell rather large, discoidal, spire small, periphery flattened convex. Volutions four or five, coiled on nearly the same plane and increasing gradually in size, the inner ones, as seen from above, rounded, with a minute elevated apex, the two outer ones strongly angulated and bearing a single row of nodules or tubercles at their outer and upper margin. On the more perfect of the only two specimens collected the characters of the tubercles are shown only on the last volution but one. At its commencement they are quite minute and closely arranged, but, as they increase in size with great regularity, at its outer termination they are about three millimetres and a half in their largest diameter and somewhat quadrangular in outline. Characters of the lower or umbilical side and those of the aperture unknown. The only surface markings that happen to be preserved are a minute spiral impressed line in the centre of the nodulous keel bordering the periphery above, and an equally minute spiral raised line on each side of it.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two natural moulds of the exterior of the upper side of the shell. The figure on Plate 31 was drawn from and the foregoing description based on a gutta percha impression of the more perfect of these two moulds.

The species appears to have been very similar in size and shape to the *Euomphalus* (or *Pleuronotus*) *DeCewi* of Billings, from the Corniferous Limestone of Ontario, but in the former the outer margin of the last two volutions is tuberculated above and probably was so below.

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* An abbreviation of the Cree name (Maskusikan sipi) for the Hay River.

CONULARIA SALINENSIS. (N. Sp.)

Plate 32, figs. 9, 9a.

Shell elongate-pyramidal, transverse section quadrangular, with the opposite sides equal and the alternate ones unequal; faces of the pyramid flattened, each marked with a rounded, narrow and longitudinal, median raised line.

In addition to this median line, the surface of each of the sides is crossed by rather regularly disposed, parallel and nearly equidistant, very narrow transverse ridges, which curve gently forward and are separated by flattened spaces whose width is rather more than twice the breadth of the ridges. When viewed under a lens, the summit of each ridge is seen to bear a single row of minute pustules, each of which is continued longitudinally forward across the flattened space next to it, as an externally minute linear prolongation. The pustules on any two immediately adjacent ridges are not opposite but alternate, so that the interior prolongations of the pustules are never continuous nor united, or confluent in such a way as to form continuous lines. On each of the sides, too, all the transverse ridges pass over the summit of the median raised line.

The only specimen collected, which though well preserved is somewhat distorted, is nearly perfect at the smaller end but broken at the larger. It actual length is about thirty millimetres. The whole of its flattened sides and a small portion of the other two are exposed, the remainder being buried in the matrix. Of the two sides which are fully exposed, the narrower one increases in breadth from two mm. at the smaller end to nine mm. and a half at a distance from it of twenty five mm., and the broader one from two mm. at the same end to thirteen mm. at a corresponding distance.

Athabasca River, opposite La Saline, R. G. McConnell, 1890: one specimen.

The discovery of this species and the elucidation of its characters, are entirely due to Mr. L. M. Lambe, who found the type specimen while breaking open a piece of argillaceous limestone containing *Leptodesma Jason*.

Its most characteristic feature seems to be the longitudinal raised line in the centre of each of its flattened sides.

CEPHALOPODA.

ORTHOCERAS.

In the collection made by Mr. McConnell at the Hay River in 1887, this genus is represented by two specimens. These are both much too imperfect for identification or description, but they clearly indicate the existence of two distinct species of *Orthoceras* in the Devonian rocks at this locality.

GYROCERAS.

A well preserved portion of what seems to have been the body chamber of a small, nodose and apparently undescribed species of *Gyroceras* was obtained by Mr. McConnell, in 1888, on the Mackenzie River, at the "Rock by the river side." In this specimen the sides are expanded, the venter and dorsum compressed, and the outline of the transverse section is obscurely octagonal, with the two angles on the dorsal side obsolete. The surface markings consist of distant nodes, arranged in longitudinal and transverse rows, and connected in both directions by obscure ridges. In each transverse row there are six of these nodes.

On the Peace River, at Vermilion Falls, a very imperfect cast of a considerable portion of the interior of the shell of the outer volution of another and very different species of *Gyroceras* was collected by Mr. McConnell in 1889. This specimen, which is of considerable size, seems to be most nearly related to the *G. submamillatum*, from the Devonian rocks of Lake Winnipegosis,[*] and may possibly be referable to that species, though it does not show any indications of a row of large and low rounded promiences on either of its sides.

GONIATITES.

Plate 31, fig. 5.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: a cast of the interior of three chambers of the septate portion of the shell of a species of *Goniatites*, in which only the lateral lobes and saddles are preserved, each ventral lobe being completely obliterated by weathering. So far as can be ascertained from such an imperfect specimen, the species appears to have the closest affinities with the *G. Ixion* of Hall,[†] from the Goniatite limestone of Rockford, Indiana, which is the type of Hyatt's genus *Brancoceras*.

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[*] Trans. Royal Soc. Canada for 1890, Sect. iv, p. 107, pl. x, figs. 1 and 1a.

[†] Pal. St. N. Y., vol. V, pt. 2, p. 474, pls. lxxiii, figs. 12-14 and lxxiv, fig, 12.

CRUSTACEA.

OSTRACODA.

PRIMITIA SCITULA, Jones.

Primitia scitula, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3,* pl. xi, figs. 14a and b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens, one on *Atrypa reticularis* and the other on *Strophodonta demissa*.

APARCHITES MITIS, Jones.

Aparchites mitis, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3, pl. xi, figs. 15a and b.

Athabasca River,—within twenty miles of the Clearwater, A. S. Cochrane, 1881, and three miles below the Calumet, R. G. McConnell, 1890. Hay River, forty miles above its mouth, R. G. McConnell, 1887. One or two specimens from each of these localities.

ISOCHILINA BELLULA, Jones.

Isochilina bellula, Jones. 1891. Contr. to Can. Micro-Pal., vol. I, pt. 3, pl. xi, figs. 16a and b.

Hay River, forty miles above its mouth, R. G. McConnell, 1887: two specimens.

TRILOBITA.

PROETUS HALDEMANI, Hall.

Plate 31, figs. 6-8.

Proetus Haldemani, Hall. 1861. Descr. New Species of Fossils, etc., p. 74.
" " " 1862. Fifteenth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 102.
" " Hall. 1876. Illustrations of Devonian Fossils, pl. xxi, figs. 7-9.

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* Now in the printer's hands, but not yet paged.

Dechenella Haldemani, Kayser. 1880. Zeitschrift der Deutsch Geol. Gesellsch., p. 707, pl. xxvii, fig. 9.
Proetus Haldemani, Walcott. 1884. Pal. Eureka distr. Nevada, p. 210.
(?) *Dechenella Haldemani*, Tschernyschew. 1887. Mem. du Comité Geol., vol. III, No. 3, p. 14, pl. i, fig. 9.
Proetus Haldemani, Hall. 1888. Pal. St. N. Y., vol. VII, p. 113, pl. xxi, figs. 7-9 and pl. xxiii, figs. 13-15.

Mackenzie River, at Grand View, several well preserved specimens, and at the "Ramparts," one badly preserved pygidium, R. G. McConnell, 1888. The specimens from Grand View consist of two separate heads, one head and thorax, two separate tails and three with the thorax attached, also of a small flat piece of limestone with one of its surfaces strewn with seven pygidia, one head and the thoracic segments of three individuals of this species.

In the following lists the species are arranged according to the localities at which they were collected, following the general direction of the drainage of the Mackenzie River and its tributaries, from the south-east to the north-west.

Pembina River, four miles above its mouth.

Spirifera inutilis, Hall.
Atrypa reticularis, var. aspera.

Clearwater River, east bank, about four miles below the Pembina.

Orthis striatula, Schlotheim.
Atrypa reticularis, L.
Spirorbis omphalodes, Goldfuss.
Ascodictyon stellatum, Nicholson.

Athabasca River, first ten miles below the mouth of the Clearwater.

Chonetes Logani, var. Aurora, Hall.
Strophalosia productoides, Nicholson.
Spirifera tullia, Hall. Var.
Athyris Angelica, var. occidentalis, W.
Atrypa reticularis.
Atrypa reticularis, var. aspera.
Actinopteria Boydii, Conrad.
Ptychopteria æquivalvis, W.
Leptodesma Demus, Hall.

Athabasca River, opposite La Saline and about twenty five miles below the mouth of the Clearwater.

Chonetes Logani, var. Aurora.
Strophalosia productoides.
Productella dissimilis, Hall.
Spirifera subattenuata, Hall.
" inutilis.
" tullia. Var.
Spirifera (Martinia) Richardsoni, M
Atrypa Angelica, var. occidentalis.
Atrypa reticularis.
Leptodesma Jason, Hall.
Conularia Salinensis, W.
Aparchites mitis, Jones.

Athabasca River, three miles below the mouth of the Calumet and eighteen miles below the mouth of Red River.

Cyathophyllum Athabascense, W.
Spirorbis omphalodes.
Hederella Canadensis, Nicholson.
Ascodictyon stellatum.
Crania Hamiltoniæ, Hall.
Productella dissimilis.
Orthis striatula.
Strophodonta demissa, Conrad.
Spirifera subattenuata.
" inutilis.
Cyrtina Hamiltonensis, Hall.
Athyris parvula, W.
Atrypa reticularis.
" " var aspera.
Rhynchonella pugnus, Martin.
Aparchites mitis.

Athabasca River, thirty miles below Red River.

Campophyllum ellipticum, var.
Ascodictyon stellatum.
Productella dissimilis.
Orthis striatula.
Strophodonta demissa.
Spirifera subattenuata.
Spirifera inutilis.
Cyrtina Billingsi, Meek.
Athyris parvula.
Atrypa reticularis.
" " var. aspera.

Peace River, between Vermilion Falls and the mouth of the Little Red River.

Cyathophyllum cæspitosum, Goldfuss.
Phillipsastræa Hennahi, Lonsdale.
Pachyphyllum Devoniense, Edw. & H.
Pachypora cervicornis, DeBlainville.
Alveolites vallorum, Meek.
Alveolites Rœmeri, Billings.
Monotrypella Unjiga, W.
Strophodonta demissa.
Strophodonta perplana, Conrad.
Spirifera disjuncta, Sowerby.
Atrypa reticularis.
" " var. aspera.
Rhynchonella cuboides, Sowerby.
Cryptonella Calvini ? Hall.
Pterinea flabellum, Conrad.

Peace River, at Rapid Bouillé.

Strophodonta demissa.

Peace River, at " Fossil Point."

Spirifera disjuncta.
Rhynchonella pugnus.

Hay River, forty miles above its mouth.

Astræospongia Hamiltonensis, M. & W.
Aulopora serpens, Goldfuss.
Cyathophyllum cæspitosum.
Campophyllum ellipticum.
Heliophyllum parvulum, W.
Phillipsastræa Hennahi.
" Verrillii, Meek.
Alveolites vallorum.
Arachnocrinus Canadensis, W.
Spirorbis omphalodes.
" Arkonensis, Nicholson.
Cornulites (Ortonia) sublævis, W.
Hederella Canadensis, Nicholson.
Proboscina laxa, W.
Stomatopora moniliformis, W.
Ascodictyon stellatum.
Paleschara quadrangularis, Nicholson.
Ceramopora Huronensis, Nicholson.
Crania Hamiltoniæ.
Productella spinulicosta, Hall.
Orthis striatula.
Strophodonta demissa.
Spirifera disjuncta.
" " var. occidentalis, W.
Spirifera cyrtinæformis, Hall & Whitfield.
Spirifera (M) glabra, var. Franklini.
Atrypa reticularis.
" " var. aspera.
Rhynchonella cuboides.
Eatonia variabilis, W.
Paracyclas elliptica, Hall.
Schizodus Chemungensis, Conrad.
Euomphalus Maskusi, W.
Primitia scitula, Jones.
Aparchites mitis, Jones.
Isochilina bellula, Jones.

Mackenzie River, at the "Rock by the river side," twenty miles below Fort Wrigley.

Chonetes Logani, var. Aurora.
Productella subaculeata, var. cataracta.

Mackenzie River, ten miles below the mouth of Bear River.

Streptelasma rectum, Hall.
Paracyclas elliptica.

Mackenzie River, at the "Ramparts."

Cyathophyllum arcticum, Meek.
Cyathophyllum (Aulophyllum) Richardsoni, M.
Pachypora cervicornis.
Alveolites vallorum.
Spirorbis omphalodes.
Cornulites (Ortonia) sublævis.
Hederella Canadensis.
Paleschara quadrangularis.
Chonetes Logani, var. Aurora.
Productella lachrymosa, var. lima, Con.
Orthis striatula.
Spirifera (M.) glabra, var. Franklini.
Spirifera (M.) meristoides, Meek.
Atrypa reticularis.
" " var. aspera.
Rhynchonella pugnus.
" castanea, Meek.
Pentamerus galeatus, Dalman.
Stringocephalus Burtini, Defrance.
Cryptonella Calvini ? Hall & Whitfield.
Newberria lævis, Meek (Sp.)
Euomphalus inops, Hall.
" flexistriatus, W.
Proetus Haldemani, Hall.

Mackenzie River, at "Grand View," forty five miles below the "Ramparts."

Productella spinulicosta.
Atrypa reticularis.
Proetus Haldemani.

According to Mr. McConnell, a section of the Devonian rocks in the Mackenzie River district, in descending order, would be somewhat as follows:—

1. Upper limestone ....(about) 300 feet.
2. Greenish and bluish shales, alternating with limestone ....(about) 500 feet.
3. Greyish limestone, interstratified with dolomites, the lower part of which may be older than the Devonian ....2000 feet (or more.)

The whole of the fossils referred to in this Report are from the upper part of the middle division of this section. Although some of the localities* at which these fossils were collected are very far apart, the writer is informed by Mr. McConnell that the lithological characters and stratigraphical relations of the shales and limestones at each are almost identical. The fossil faunæ at the whole of these localities seem to show similarly close relations, and it is most probable that all the species in the foregoing lists are from practically the same geological horizon.

An analysis of these lists shows that twenty two of the species are found also in the Hamilton Formation of Ontario or the State of New York.

These are:—

Astræospongia Hamiltonensis.
Aulopora serpens.
Streptelasma rectum.
Pachypora cervicornis.
Alveolites Rœmeri.
Spirorbis omphalodes.
" Arkonensis.
Cornulites (Ortonia) sublævis.
Hederella Canadensis.
Ascodictyon stellatum.
Paleschara quadrangularis.
Cerampora Huronensis.
Crania Hamiltoniæ.
Chonetes Logani, var. Aurora.
Strophodonta demissa.
" perplana.
Productella spinulicosta.
Atrypa reticularis.
Cyrtina Hamiltonensis.
Pterinea flabellum.
Actinopteria Boydii.
Proetus Haldemani.

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* The Ramparts, on the Mackenzie, for instance, are 570 miles from the locality on the Hay River at which fossils were collected, and nearly 1,000 miles from La Saline on the Athabasca.

Ten of the species occur also in Iowa, in beds that are now referred to the Chemung.

These are:—

Campophyllum ellipticum.
Hederella Canadensis.
Productella dissimilis.
Orthis striatula. (=O. Iowensis.)
Strophodonta demissa.
Spirifera cyrtinæformis.
Atrypa reticularis.
" " var. aspera.
Rhynchonella pugnus. (=R. alta.)
Cryptonella Calvini.

Seven are identical with species that are said to be characteristic of the Chemung of the States of New York and Pennsylvania.

These are:—

Productella lachrymosa, var. lima.
Spirifera disjuncta.
Athyris Angelica.
Rhynchonella cuboides. (venustula.)
Leptodesma Demus.
" Jason.
Schizodus Chemungensis.

In the Mackenzie River district, however, the subdivisions of the Devonian System that exist in the State of New York and Ontario are probably not recognizable, and there are strong reasons for supposing that the whole of the fossils reported upon in these pages belong to the "Cuboides Zone."

It is true that *Rhynchonella cuboides* itself has so far been found only on the Peace and Hay Rivers, where it is invariably associated with *Spirifera disjuncta* (or *Verneuili*), but other fossils eminently characteristic of the Cuboides Zone will be noticed in nearly all the foregoing lists of species from the Athabasca and its tributaries or from the Mackenzie.

In a paper published as a Bulletin of the Geological Society of America and dated May, 1890, Prof. H. S. Williams cites three species, which, according to Kayser, are the "principal fossils of the Cuboides Schichten" in Europe, and thirteen others as "conspicuous fossils in its fauna." Of the first three, two are *Rhynchonella cuboides* and *Spirifera disjuncta* (or *Verneuili,*) which, as before stated, occur together at the Peace and Hay Rivers. Of the thirteen others, five, viz., *Productella subaculeata, Orthis striatula, Atrypa reticularis, Rhynchonella pugnus* and *Pentamerus galeatus* are found in one or other of the lists of species on pages 247–50. *Pachypora cervicornis*, too, which was collected at the "Ramparts" by Mr. R. W. McFarlane in 1857, and *Strophalosia productoides*, which has since been found by Dr. Bell and Mr. McConnell in the Devonian rocks of the Athabasca, are both stated to be characteristic of the Cuboides Zone in Europe. The *Cyathophyllum hexagonum* of the Cuboides Zone of Belgium is represented at the "Ramparts" by

C. arcticum, and the *Spirifera concentrica* of the same zone and locality, by the *Athyris parvula* of the Athabasca, which is little more than a diminutive race of *S. concentrica.*

Prof. Williams correlates the Cuboides Zone of Europe with the Tully Limestone of the State of New York, together with certain "shaly strata several hundred feet above it." He suggests also that "if we wish to express precise correlation in our classification of American rocks, the line between middle and upper Devonian formations should be drawn at the base of the Tully Limestone, to correspond with the usage of French, Belgian, German and Russian geologists, who include the *Frasnien*, *Cuboides Schichten*, and correlated zones in the upper Devonian." For comparison with the fauna of the Cuboides Zone in Europe, Prof. Williams says that "the more important species in the Tully Limestone of New York are the brachiopods, of which he gives a list of thirteen. Of these, *Chonetes Logani*, var. *Aurora*, *Productella spinulicosta*, *Strophodonta perplana*, *Spirifera tullia*, *Cyrtina Hamiltonensis*, *Atrypa reticularis*, *Atrypa aspera* and *Rhynchonella venustula* (*cuboides*) occur also in the Devonian of the Mackenzie River district. The large variety of *Orthis Tulliensis*, from the Tully Limestone, figured by Prof. Williams, also, is practically indistinguishable from some of the specimens of *O. striatula* from the Athabasca River, Hay and Peace Rivers.

The occurrence of two specimens of *Stringocephalus Burtini*, associated with several examples of *Rensselaeria lævis*, Meek (not Hall), and the apparent absence of *Spirifera disjuncta*, at the "Ramparts," on the Mackenzie River, are, doubtless, rather suggestive of the "Stringocephalus limestone," but nearly all the other species found at this locality are characteristic of the Cuboides Zone as developed in Europe, or of its American representative the Tully Limestone.

Finally the following table has been prepared to shew the close resemblance which the fauna of the Devonian rocks of the Mackenzie River district, as exemplified in these pages, bears to that of the same formation in Europe or upon the European side of the Atlantic.

MACKENZIE RIVER DISTRICT.	EUROPE.
Aulopora serpens.	Aulopora serpens.
Cyathophyllum arcticum.	Cyathophyllum hexagonum.
Cyathophyllum cæspitosum.	Cyathophyllum cæspitosum.
Cyathophyllum Athabascensis.	Cyathophyllum ceratites, Goldfuss.
Campophyllum ellipticum.	Campophyllum Seetenicum, Schluter.
Phillipsastræa Hennahi.	Phillipsastræa Hennahi.
Pachyphyllum Devoniense.	Pachyphyllum Devoniense.
Pachypora cervicornis.	Pachypora cervicornis.

MACKENZIE RIVER DISTRICT.	EUROPE.
Spirorbis omphalodes.	Spirorbis omphalodes.
Stomatopora moniliformis.	Hippothoa Devonica, Œhlert.
Strophalosia productoides.	Strophalosia productoides.
Productella subaculeata, var. cataracta.	Productella subaculeata.
Productella spinulicosta.	Productella spinulicosta.
Orthis striatula	Orthis striatula.
Spirifera disjuncta.	Spirifera disjuncta.
Spirifera cyrtinæformis.	Sp. aperturatus, var. cuspidatus.
Spirifera glabra, var. Franklini.	Spirifera glabra.
Spirifera Richardsoni, Meek.	Spirifera undifera, Rœmer.
Cyrtina Hamiltonensis.	Cyrtina heteroclita (Auct.)
Atrypa reticularis.	Atrypa reticularis.
Atrypa reticularis, var. aspera.	Atrypa reticularis, var. aspera.
Rhynchonella pugnus.	Rhynchonella pugnus.
Rhynchonella cuboides.	Rhynchonella cuboides.
Pentamerus galeatus.	Pentamerus galeatus.
Stringocephalus Burtini.	Stringocephalus Burtini.
Newberria lævis, Meek. (Sp.)	Rensselæria amygdalina, Goldfuss (Sp.)
Pterinea flabellum.	Pterinea fasciculata, Goldfuss.
Paracyclas elliptica.	Lucina proavia, Goldfuss.
Proetus Haldemani, Hall.	Proetus Haldemani.

GEOLOGICAL SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME 1.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART IV.

6. The Fossils of the Devonian Rocks of the islands, shores or immediate vicinity of Lakes Manitoba and Winnipegosis.

OTTAWA:
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY.
1892.

The present report, which forms Part IV of Volume I of the "Contributions to Canadian Palæontology," is a memoir "on the Fossils of the Devonian rocks of the islands, shores or immediate vicinity of Lakes Manitoba and Winnipegosis," consisting of 105 pages of text, illustrated by fifteen full page plates. The drawings for these plates were made by Mr. L. M. Lambe, the artist to the Survey, and lithographed by Messrs. Mortimer & Co., of Ottawa.

In the introductory letter to Part III it was stated that the volume would be concluded with Part IV, but, since the paper "on the fossils of the Hamilton formation of Ontario" was published in Part II, so much new material has been obtained, that it is thought desirable to include in this volume, as Part V, a supplement to that paper.

ALFRED R. C. SELWYN.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, December 15th, 1892.

GEOLOGICAL SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY

VOLUME I.

BY J. F. WHITEAVES.

6. *The Fossils of the Devonian Rocks of the islands, shores or immediate vicinity of Lakes Manitoba and Winnepegosis.*

INTRODUCTION.

The northern extremity of Lake Winnepegosis, it may be well to premise, is in the District of Saskatchewan, but by far the larger portion of that lake and the whole of Lake Manitoba are in the province of Manitoba. The shores of the southern portion of Lake Manitoba are so low and flat as to exhibit no rock exposures, and the area from which the fossils referred to in this report are collected is included between latitudes 51° and 53° N, and longitudes 98° 30′ and 101° 10′ W.

Prior to the year 1888 but little was known of the fauna of the Devonian rocks of the islands and shores of Lakes Manitoba and Winnepegosis, or of the geographical distribution and stratigraphical relations of these rocks. Up to that date, the little that was known on either of these topics is to be found in Professor H. Youle Hind's official "Report on the Assiniboine and Saskatchewan Exploring Expedition," published at Toronto by the Ontario Government in 1859, and in Mr. (now Dr.) J. W. Spencer's "Report on the country between the Upper Assiniboine River and Lake Winnepegosis and Manitoba," published at Montreal in 1875, in the Report of Progress of the Geological Survey of Canada for 1874-75.

In the earlier of these two publications the existence in Manitoba of rocks of Devonian age was first announced by Mr. E. Billings, on the evidence of a few fossils collected by Prof. Hind at Snake Island, Lake Winnipegosis, and at Manitoba Island, Lake Manitoba, which were presented by or through him to the Museum of the Survey. The fossils from Snake Island, as identified or described by Mr. Billings in the twentieth chapter of Prof. Hind's report, are as follows: *Atrypa reticularis*, L., and its var. *aspera*; *Orthis Iowensis*, Hall; "two small species of *Productus*;" "*Lucina elliptica*, Conrad;" *Lucina occidentalis*, Billings (sp. nov.); two species of *Euomphalus*; "a fragment of a *Loxonema*, most probably *L. nexilis*"; "fragments of *Orthoceras*, *Gomphoceras*, and a species of *Nau-*

tilus or *Gyroceras*." In reference to these Mr. Billings remarks that "although we have none of the characteristic spirifers, corals or trilobites to guide us, yet I think that upon the evidence of the above fossils we can safely say that this locality is Devonian and most probably about the age of the Hamilton group." The fossils from Manitoba Island, he adds, "are mostly the same as those from Snake Island, with the exception of two species of *Chonetes* and fragments of a large fish. There is also here a large *Stromatopora*, probably *S. concentrica*."

The present writer has never seen the specimens referred to by Mr. Billings as "two small species of *Productus*," and as "two species of *Euomphalus*"; but, apart from these, the following is submitted as an amended list of the species obtained by Prof. Hind at Snake Island: *Orthis striatula*, Schlotheim (=*O. Iowensis* of Billings and Meek); *Atrypa reticularis*, L.; *Atrypa reticularis*, var. *aspera*, Schl.; *Paracyclas elliptica*, Hall, non Conrad, of which *Lucina occidentalis*, Billings, which is incorrectly figured by his artist, is only a distorted form, both it and the typical *P. elliptica* being very doubtfully distinct from *P. lirata*, Conrad; *Loxonema*, species undeterminable, the specimen being a mere fragment; *Orthoceras Hindii (=Actinoceras Hindii*, Whiteaves, but not a true *Actinoceras); Gomphoceras*, species undeterminable; and *Gyroceras submamillatum*, Whiteaves. The four specimens of *Chonetes* collected by Prof. Hind at Manitoba Island, and seventeen precisely similar ones obtained by Mr. Tyrrell and the present writer at the same locality in 1888, are all clearly referable to a single species, which is described and figured in this report under the name *Chonetes Manitobensis*. The exposures of Devonian limestone examined by Prof. Hind are those at Flat Rock Point, Steep Rock Point and Manitoba Island, on or in Lake Manitoba, and at Snake Island, in Lake Winnipegosis.

In 1874 Dr. J. W. Spencer examined several outcrops of Devonian rocks on the shores of Swan Lake, Manitoba, and Lake Winnipegosis, and gave the name of Dawson Bay to the north-western portion of the latter, in honour of Sir J. W. Dawson, the principal of McGill University. About a page and a half (pp. 61-62) of Dr. Spencer's Report is devoted to a general description of Lakes Winnipegosis and Manitoba, and two pages (pp. 67-68) to an account of the "Deposits of Devonian Age" in and around Lake Winnipegosis and Swan Lake. On page 68 he states that "the best localities for fossils, so far as my observation extended, are Warren Island, in Swan Lake, and Points Wilkins and Carrollida, on Dawson Bay. The palæozoic fossils which I collected have been determined by Mr. Billings, who pronounces them all to be of Devonian age. The following were collected from rocks *in situ* at the above localities: *Athyris*, *Cyrtina*, *Atrypa aspera*, *A. reticularis* (Devonian type), *Spirifera* and *Orthis*." The "*Athyris*" of this list is *A. vittata*, Hall, and the

"*Cyrtina*" most probably *C. Hamiltonensis* of Hall. "The following," he says, "were obtained on the western shore of Dawson Bay, from slabs apparently derived from the neighbouring cliffs: *Receptaculites* (?), *Favosites* (2 species), *Syringopora*, *Acervularia profunda* (this occurs in the Hamilton group in Iowa), *Heliophyllum* (like *H. Halli*), *Diphyphyllum*, *Stromatopora*, crinoidal columns, *Gypidula*, *Rhynchonella*, *Atrypa reticularis*, *Athyris*, *Strophomena*, a brachiopod resembling *Stringocephalus*, *Euomphalus*, *Pleurotomaria*, *Bellerophon* and *Phillipsia*." The specimens referred to in this list as "*Receptaculites* (?)" are two worn examples of *Sphærospongia tessellata*; the two species of *Favosites* are *F. Gothlandica*, var., and *Pachypora cervicornis*; the "*Heliophyllum* like *H. Halli*" is a new species of *Actinocystis*, which will be found described and figured in this report as *A. variabilis*; the "*Gypidula*" is *Pentamerus comis*; the "brachiopod like *Stringocephalus*" is *S. Burtini*; the "*Euomphalus*" is a small species of *Straparollus* here described and figured as *S. filicinctus*; the "*Bellerophon*" appears to be *B. Pelops*, Hall, and the "*Phillipsia*" a variety of *Proetus Haldemani*. To this list, also, may be added *Orthothetes Chemungensis*, var., and *Conocardium Ohioense*, Meek, which Prof. Whitfield says is the young of *C. trigonale*, Hall, though Prof. Hall himself says that his *C. trigonale* is a synonym of Conrad's *C. cuneus*. Finally, Dr. Spencer says, "among other specimens which had evidently been transported from a greater or less distance, there were *Pentamerus*, *Atrypa reticularis*, *A. aspera*, *Strophomena*, *Chonetes*, *Euomphalus*, &c. The "*Pentamerus*" of this list is a Silurian species, which has since been described by the present writer under the name *P. decussatus*, and which, so far, has only been found *in place* at the foot of the Grand Rapids of the Saskatchewan.

By far the most complete examination of the geology around Lakes Manitoba and Winnipegosis that has yet been made, was effected by Mr. J. B. Tyrrell, M.A., B.Sc., of this Survey, in the summer seasons of 1888 and 1889. All the rock exposures on the islands, shores and immediate vicinity of these two lakes were examined by Mr. Tyrrell, who outlined the boundaries of the belt of Devonian rocks across this tract of country, discovered many new fossils in these rocks, and traced out the horizons in which these fossils occur, as well as the stratigraphical relations of the different bands of limestone to each other and to the Cretaceous rocks by which they are overlaid. In 1888 he discovered a small exposure of rocks of Silurian (Upper Silurian) age at Davis Point, Portage Bay, Lake Manitoba, and in 1889 a large area of rocks of the same age on the north-eastern shore of Lake Winnipegosis. During both these years he was assisted by Mr. D. B. Dowling, B.A.Sc., in a topographical survey of this district and in the collection of fossils, and in the summer of 1888 the present writer had the pleasure of visiting nearly all the fossiliferous exposures in or around Lake Manitoba in company with Mr. Tyrrell. The collections of fossils which Mr. Tyrrell obtained from the Devonian rocks of the neighbourhood of these two lakes on the occasions referred to, and which will form the subject of the present report, are among the largest and most important that have been brought back by any of the Survey explorers for many years. The species represented in these collections are of unusual interest, not only on account of the number of new forms among them, but also as showing the close relations that exist, in so many respects, between the fauna of these rocks and that of the Devonian rocks of Europe. As several of the localities mentioned in this report are not to be found in any of the older maps, it may be mentioned that they are all laid down on the "Geological Map of North-western Manitoba and portions of the districts of Assiniboia and Saskatchewan," recently published by this Survey, and here referred to as Mr. Tyrrell's map.

The whole of the species enumerated or described in this paper appear to be from the Middle or Upper Devonian, in the sense in which these terms have been recently used by Kayser, Tschernyschew and other European writers. By far the larger number are from the Stringocephalus zone, and, in order to avoid repetition, a capital s (S) will be prefixed to the names of each of these. According to Mr. Tyrrell, the rocks which are here called Middle Devonian, consist of "a series of dolomites which extend upward from the basal beds at Devils Point, Lake Winnipegosis, to the upper beds exposed on the islands and shores of Dawson Bay, in which *Stringocephalus* is particularly abundant. The Upper Devonian of this district consists of a series of more or less impure limestones, extending from the lowest beds at Onion Point, Lake Manitoba; Snake Island, Lake Winnipegosis, and a few other localities, through the light grey shales" (of the Cuboides zone) "on the Red Deer River, &c., to the light pinkish limestones at Point Wilkins."

In the preparation of this paper the writer is indebted to Mr. L. M. Lambe, F.G.S., of this Survey, for valuable assistance in ascertaining the exact character of many of the species, especially the internal structures of the corals and the minute generic and specific features of the Polyzoa; to Dr. Fritz Frech, of Halle, Germany, who paid a short visit to Ottawa in October last, for critical suggestions in regard to the affinities of the Cyathophyllidæ; and to Mr. E. O. Ulrich, of Newport, Kentucky, for notes on the specific relations of some of the Polyzoa.

The classification followed, as in previous parts of this volume, is mainly that adopted by Dr. Karl Zittel in his "Handbuch der Palæontologie," but the corals are arranged in conformity with Dr. Frech's memoir on the Cyathophyllidæ and Zaphrentidæ of the German Middle Devonian* and the Polyzoa or Bryozoa in accordance with Mr. Ulrich's recently published monograph of the "Palæozoic Bryozoa," in the eighth volume of Reports of the Geological Survey of Illinois.

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* Palæontol. Abhandl. herausgeg., von W. Dames & E. Kayser. Berlin, 1886. Vol. III pt. 3.

Determinations and Descriptions of Species.

RECEPTACULITIDÆ.

(S.) Sphærospongia tessellata, Phillips. (Sp.)

Plate 33. All the figures.

Sphæronites tessellatus, Phillips. 1841. Pal. Foss. Dev., Cornw. & W. Somers., p. 135, pl. lix, fig. 49.
Echinosphærites tessellatus, Murch., De Verneuil & Keyserling. 1845. Geol. Russ., &c., vol. II, p. 381, pl. xxvii, fig. 7.
Sphæronites tessellatus Bowerbank. 1845. Ann & Mag. Nat. Hist., p. 299.
" " Austin. " Ib., p. 406.
Proboscis of crinoid. G. & F. Sandberger. 1850–56. Verstein des Rhein. Schicht. —Syst., pp. 384, 385.
Sphærospongia tessellata, Pengelly. 1861. Geologist, vol. IV, p. 340, pl. v.
Pasceolus tessellatus et *Rathii*, Kayser. 1875. Zeitschr. der. deutsch. Geol. Gesellsch., p. 780, t. xx.
Polygonosphærites tessellatus, F. Roemer. 1880. Leth. Pal. vol. I, p. 297, fig. 54.
" " Zittel. 1880. Handb. der Palæont., vol. I, p. 106.
Dictyophyton gerolsteinense, F. Roemer. 1883. Zeitschr. der. deutsch. Geol. Gesellsch, vol. XXXV, p. 706, fig. b.
Sphærospongia tessellata, Hinde. 1884. Quart. Journ. Geol. Soc. Lond., vol. XL, p. 840, pl. xxxvii, figs. 1, 1a—c.

Two badly worn and loose specimens of a fossil which E. Billings referred with doubt to the genus *Receptaculites*[*], were collected by Dr. J. W. Spencer in 1874, on the western shore of Dawson Bay, Lake Winnipegosis. On examining these specimens in the spring of 1888, the writer became convinced that they are identical with the *Sphærospongia tessellata*, Phillips, (sp.) as described and figured by Dr. G. J. Hinde and others. A single specimen of the same species was collected by Mr. A. P. Low, in 1886, at the Limestone rapids of the Fawn branch of the Severn River.

In July, 1888, four tolerably good specimens of *S. tessellata* were obtained by Mr. J. B. Tyrrell and the writer on the north-west shore of Lake Manitoba, at Pentamerus Point. Two of these specimens were loose, but the other two were found in place, in a pale yellowish-brown coloured or nearly white dolomite of Devonian age, associated with *Stringocephalus.*

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[*] Geol. Surv. Canada, Rep. Progr. 1874-75, 1875, p. 68.

In 1889, a large number of specimens of a *Sphærospongia*, which, in the writer's judgment, are undoubtedly identical with *S. tessellata*, were collected by Messrs. Tyrrell and Dowling at several localities on the shores and islands of Dawson Bay, especially on its south-eastern shore, at a point four or five miles north of the mouth of Shoal River, called Whiteaves Point on Mr. Tyrrell's map. These specimens, some of which are in unusually fine condition, were obtained in place, from a partly compact and partly vesicular dolomite, also holding *Stringocephalus.* The originals of all the figures on plate xxxiii are from Dawson Bay.

At this locality the specimens are more or less curved or twisted, especially near the base, the most curved specimen collected being that represented by fig. 6. They vary considerably in shape, size and proportions, but they all enclose a large central cavity. In some specimens the contour is subpyriform (figs. 1, and 10) and the height not much greater than the maximum breadth. Others, again, are subconical (fig. 9), arcuate and club-shaped (fig. 6), or even almost cylindrical (fig. 4), and the latter, of course, are much higher than broad.

The details of their structure have been carefully studied by Mr. L. M. Lambe. He finds "that, with the exception of a basal circlet and a very small area at the summit, the whole of the outer surface of the organism consists of close fitting hexagonal plates, which are slightly convex on their outer surface, arranged in alternating vertical rows, and that each plate has a small rounded elevation or tubercle in the centre, as described and figured by Phillips, Hinde and others. In addition to the central elevation, each of the hexagonal plates in the Dawson Bay specimens is marked by a few lines of growth parallel to the periphery, as shown in fig. 2.

The base of the organism is entirely closed, pointed and composed of four longitudinally elongated, five-sided plates, as represented in figs. 5 and 5a. These basal plates are marked with sculpture lines similar to those of the hexagonal plates, but in each of the basals the central or subcentral portion is developed into a comparatively large protuberance.

The external characters of the summit are not yet satisfactorily known, but in the only specimen in which any portion of it is preserved (fig. 1) the appearance is as there indicated, and there are no indications that the summit was covered by hexagonal plates.

The interior of the fossil presents the appearance of a number of interlocking, hollow cruciform 'spicules,' each of which has its central and undivided portion anchylosed to the centre of the inner surface of one of the hexagonal plates. The four rays of each 'spicule' lie in a plane parallel to that of the plate of which they form a part, and project considerably beyond its margin, but in two of the rays the general direction is vertical, and in the other two horizontal or lateral. All the rays are thickened at their junction with each other, striated longitudinally, and taper gradually to an acute point. The horizontal or lateral rays are longer than the vertical, and the former are curved slightly inward and downward. The distal rays, or those vertical rays which are directed forward, incline slightly inward, and the proximal rays, or those vertical rays which are directed backward, incline as slightly outward.

The rays of the 'spicules' of immediately adjacent plates interlock in a very regular manner, as shown by Dr. Schluter in his figure of *S. megaraphis** and as specially indicated in fig. 1 a, of plate xxxiii, in which the dotted lines represent the relative position of the hexagonal plates. The distal ray of each 'spicule' passes behind or inside of the proximal ray of the 'spicule' immediately above it. The lateral rays of each 'spicule' pass between the distal and proximal rays of the 'spicules' lying to the right and left of it, while the right lateral ray of each 'spicule' passes above the left lateral ray of the corresponding 'spicule' in the second row to the right of it.

In the narrow portion next to the base the 'spicules' appear to be partially amalgamated and are less clearly defined, so that this part of the fossil often presents a longitudinally ribbed appearance, the ribs being rounded or flattened and convergent posteriorly.

At the summit the distal rays of the last two or three 'spicules' in each longitudinal row are prolonged and convergent and ultimately meet together at its apex. These prolonged summit rays are hollow and flattened laterally and the central summit area formed by them is about fourteen millimetres broad at the base, in the only specimen (fig. 1.) in which it is preserved.

In attempting to free the organism from the matrix, the rock in these specimens from Dawson Bay often carries with it the outer covering of hexagonal plates. The result of the fracture of these plates from the 'spicules' of which they formed a part, is shown in fig. 1 a. When the rays of the 'spicules' are not present, which is often the case, their original shape and position are indicated by corresponding moulds of their exterior in the matrix. The spaces between the spicules, also, are represented by raised ridges crossing each other at right angles and directed diagonally across the specimen, thus giving the peculiar reticulated appearance shewn in figs. 1 and 4.

The maximum breadth of the largest specimen collected, which is too imperfect to show the height, is fifty six millimetres. The most perfect specimen is forty mm. high and twenty eight mm. in its maximum breath. In the central portion of this specimen the dimensions of the rays of the 'spicules,' as measured from the centre of each 'spicule,' are as follows: length of the proximal rays, 3·5 mm., length of the horizontal or lateral rays 5·5 mm.; thickness of the rays at their bases 9 mm. The dimensions of the four basal plates shown in figs 5 and 5a are, length 4·5 mm., breadth 3·0 mm. The subcylindrical specimen represented by fig. 4 is rather more than 35 mm. in height, and 12·5 mm. in its greatest breadth."

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* Zeitschr. der Deutsch. geol. gessellsch., 1887, vol. XXXIX, pl. i, fig. 6.

This species is the type of Pengelly's genus *Sphærospongia*, which was first characterized in 1861, and of Ferdinand Roemer's genus *Polygonosphærites*, which was published in 1880. It is still doubtful which of these names should be retained, the first having been given on the hypothesis that the organism was originally a sponge, and the second on the assumption that it was not. Of late years Phillips' species has been referred to *Sphærospongia* by Dr. G. J. Hinde in 1884 (op. cit.) and by Dr. Clemens Schluter in 1887*, but to *Polygonosphærites* by Zittel in 1883†, and by Herr Rauff‡, as well as by Professors Nicholson and Lyddeker in 1889§. Dr. Hinde claims that it is a Lyssakine Hexactinellid sponge, but Herr Rauff maintains that it and the Receptaculitidæ are not silicious organisms, but that their skeletons were originally calcareous and the silicious specimens mere pseudomorphs, or the result of subsequent silicification. The group therefore, he concludes, cannot be referred to the Hexactinellid sponges, and its systematic position is still entirely uncertain. In the present Report, however, the generic term *Sphærospongia* is still retained, though not without some hesitation, on the ground that the hypothesis that the type of the genus was not a sponge, has not yet been conclusively proved.

A specimen of a *Sphærospongia* which appears to be indistinguishable from the present species, has been figured under the name *S. cornucopiæ*, Goldfuss (Sp.)|| by Dr. Schluter, who states that it was recorded (aufgeführt) by Goldfuss in 1832 as occurring in the Devonian rocks of the Eifel and named by him *Scyphia cornucopiæ*. The volume in which the latter name was first indicated is inaccessible to the writer, but it would seem that the species was never properly characterized by Goldfuss, and hence that his specific name cannot be accepted as prior to Phillips', for, on page 30 of Davidson's Monograph of the British Devonian Brachiopoda the following passage occurs. "In 1833" (according to Dr. Schluter this

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* Zeitschr. der Deutsch. geol. Gesellsch., Berlin, vol. XXXIX, p. 13, pl. 1, figs. 1 and 2.

† Handbuch der Palæontologie, vol. I, p. 728.

‡ Zeitschr. der Deutsch. geol. Gesellsch., Berlin, vol. XL, p. 609.

§ Man. Palæont., 1889, vol. II, App., pp. 1563-64.

|| Zeitschr. der Deutsch. geol. Gesellsch., 1887, vol. XXXIX, pl. 1, figs. 1 and 2.

should be 1832) "Goldfuss appended a list of fossils to Von Dechen's translation of Sir Henry de la Beche's 'Manual of Geology' and introduced a number of new names without description or illustration, and has thus furnished us with another instance of the confusion that can be created by the pernicious effect of manuscript names."

SPONGIÆ.

(S.) ASTRÆOSPONGIA HAMILTONENSIS, Meek and Worthen.

For the synonymy of this species see page 197.

East side of Lake Winnipegosis, on a small island east of the south end of Birch Island, and about four miles north-east of Wade Point: a single six-rayed spicule, which appears to be essentially similar to that represented on plate xxviii (figs. 1 and 1a) of the present volume.

ANTHOZOA.

ZOANTHARIA.

CYATHOPHYLLUM, Goldfuss.

Group of *Cyathophyllum heterophyllum*, M. Edwards and Haime.

CYATHOPHYLLUM VERMICULARE, Goldfuss, var. PRÆCURSOR, Frech.

Plate 35, figs. 1, 1a and 1b.

Astrocyathus vermicularis, Ludwig. 1866. Korallen aus palæolithischen Formation (Palæontographica, vol. XIV.) t. 58.

Cyathophyllum vermiculare, Goldf. mut. n. *præcursor*. Frech. 1886. Die Cyathophylliden und Zaphrentiden des deutschen Mitteldevon, (Palæontol. Abhandl., Dames and Kayser, vol. III) p. 63, pl. ii. (xiv.) figs. 4, 6, 7, 8, 9, 10.

Red Deer River, at the Upper Salt Spring and about five miles from Dawson Bay, Lake Winnipegosis, D. B. Dowling, 1888: one small specimen. Lake Winnipegosis, at the south end, on a small island near Charlie Island (the specimen figured) and at the north end of Snake Island (one specimen); also on the south-west side, at the north side of South Manitou Island (one specimen), and on the south-east side, at Point Brabant (one specimen): J. B. Tyrrell and D. B. Dowling, 1889. Red Deer River, near the Lower Salt Spring, and two or three miles from Dawson Bay (four specimens) and at the Upper Salt Spring, two or three miles further up the river (six specimens): J. B. Tyrrell, 1889.

The identification of the specimens from these localities with the European coral named above, is given on the authority of Dr. Frech himself, who examined the whole of them carefully during a visit to Ottawa in October, 1881. The individual figured represents a short and broad form of this coral, others being much longer in proportion to their breadth, and more narrowly sub-cylindrical. These latter approach very nearly in form to the *C. Richardsoni*, of the Devonian rocks of the Mackenzie River basin, which belongs to this section of the genus, but according to Dr. Frech, the septa of *C. Richardsoni* are thicker and less numerous than those of his *C. vermiculare*, var. *præcursor*.

Group of *Cyathophyllum ceratites*. Goldfuss.[*]

CYATHOPHYLLUM DIANTHUS, Goldfuss. Teste Frech.

Cyathophyllum dianthus, Goldfuss. 1826. Petref. German, vol. I., p. 34, pl. xvi. figs. 1 b, c, d, but not figs. 1a-e, nor pl. xv., fig. 13.
" " Frech. 1886. Die Cyathophyll. und Zaphrent. des deutsches Mittel.-Devon, (in vol. III. of Dames & Kayser's Palœontol. Abhandl.), p. 68, which see for a full list of synonyms of European specimens of this species.
Cyathophyllum cæspitosum, Whiteaves, non Goldfuss. *Pars*. 1891. This volume, p. 200, pl. xxvii., figs. 7 and 8.

Dr. Frech, who has examined the specimens referred to *C. cæspitosum*, Goldfuss, on page 200 of the present volume, thinks that the small mass of loosely aggregated corallites from the Peace River, collected by Professor Macoun in 1875, is conspecific with *C. cæspitosum*, but that the simple, or nearly simple, specimens from the Hay River, collected by Mr. McConnell in 1887, are referable to *C. dianthus*, Goldfuss. A single example of a coral which has precisely the same internal structure as these Hay River specimens of *C. dianthus*, and which differs from them chiefly in having six lateral buds, was collected by Mr. Tyrrell in 1889, at the Lower Salt Spring on the Red Deer River.

CYATHOPHYLLUM WASKASENSE.[†] (N. Sp.)

Plate 34, figs. 5, 5 a, 6 and 7.

Corallum simple (figs. 5 and 5a), or proliferous and consisting of a single corallite from which as many as from four to six lateral and divergent buds proceed (fig. 6), or increasing by calycinal gemmation (fig. 7), the simple forms and those from which lateral buds are produced being conical, rather slender and more or less curved or bent. Epitheca faintly ribbed longitudinally, transversely striated and marked also with a few irregularly disposed constrictions and re-elevations, the results of periodic arrests of growth: calyx rather deep, flat at the bottom and with nearly vertical sides : primary septa twenty four, extending about half way to the centre and slightly irregular : secondary septa equal in number to the primaries, but not reaching more than half as far inward. Internal structure, as seen in longitudinal sections, consisting of a very narrow outer zone of vesicular tissue and of a broad inner tabulate area. The vesicles are small and rather regularly disposed, while the tabulæ, which are for the most part complete and regular in their disposition, are very close-set flat in the centre but bent downward at their outer margins.

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[*] Dr. Frech thinks that the coral from the Hay river, described under the name of *Campophyllum ellipticum* on pages 202 and 203 of the present volume, and figured on plate XXVII (figs. 5 and 6), is a *Cyathophyllum* belonging to this group, and possibly a variety of his *C. Lindströmi*.

[†] From the Cree name for the Red Deer River, which, according to Mr. Tyrrell, is Waskasew Sipi.

Red Deer River, at the Upper Salt Spring and about five miles from Dawson Bay, Lake Winnipegosis, J. B. Tyrrell, 1889 ; abundant. Beardy Island, Dawson Bay, J. B. Tyrrell, 1889 : one specimen.

The specimens for which the foregoing name is proposed appear to differ from those which are here referred to *C. dianthus*, in the much greater regularity and completeness of the tabulæ in the central tabulate area.

CYATHOPHYLLUM PETRAIOIDES. (N. SP.)

Plate 34, figs. 1, 1a and 2.

Corallum simple, straight or slightly curved, in well preserved specimens attached to some foreign body by a small and partially clasping basal expansion, conical and broadly spreading, the entire height being not much greater than the width at the summit. Outer surface marked with faint longitudinal costæ, also by fine transverse striæ and a few rather coarse wrinkles at irregular intervals. Calyx circular, oblique in some specimens but not in others, subconical but irregular in shape, usually very deep and in most cases excavated to within an extremely short distance of the base : septa about forty five in number and apparently equal in size, consisting of mere ridges, which are acute and moderately prominent in the upper portion of the sides of the cup, but which are much more strongly developed at and towards its base. Internal structure, as shown in longitudinal sections, consisting of vesicular tissue between the septa : tabulæ almost but not entirely absent, a single transverse diaphragm at the bottom of the cup being observable in two out of the ten specimens collected.

Dimensions of the specimen figured : greatest height, thirty nine millimetres, maximum width, twenty nine mm. In another specimen the greatest height is about forty mm., and the width at the summit thirty two.

Onion Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 : one specimen.

Small island at the extreme south end of Lake Winnipegosis, J. B. Tyrrell, 1889 : one specimen. Red Deer River, at the Lower Salt Spring (five specimens) and at the Upper Salt Spring (four specimens) : J. B. Tyrrell, 1889.

This species is singularly like a *Petraia*, both in its external shape and internal structure, but it differs from that genus in the development of vesicular tissue between the septa. It resembles the "*Zaphrentis solida*" of Hall and Whitfield, from the Devonian rocks of Iowa, in many respects, but differs therefrom in the almost entire absence of tabulæ. In *Z. solida* the tabulæ are described as "distinct, closely arranged" and "extending half the diameter of the cup." If all the specimens collected by Mr. Tyrrell and the present writer had been of small size, the absence of tabulæ in them might be attributable to their being immature individuals in which these structures were not yet developed, but, as a matter of fact, most of the specimens of *C. petraioides* are considerably larger than the largest known examples of *Z. solida*.

Group of *Cyathophyllum hexagonum*, Goldfuss.*

(S.) CYATHOPHYLLUM ANNA, Whitfield. (Sp.)

Stylastræa Anna, Whitfield. 1882. Ann. N. Y. Acad. Sci., p. 199.
" " " 1890. Ib., p. 520, pl. vi., figs. 1-5.

Lake Manitoba, on the east side of the Narrows, J. B. Tyrrell, 1888 : one specimen. Dawson Bay, Lake Winnipegosis, at Whiteaves Point (four specimens), and on a small island close to the north-west end of Beardy Island (six specimens) ; J. B. Tyrrell, 1889. A single specimen of a coral collected by Dr. R. Bell in 1877, from the Long Portage of the Missinaibi River, in the district of Algoma, and referred to in the Report of Progress of this Survey for 1887-88 (page 5, c) as *Cyathophyllum Davidsoni*, has since been found to be referable to the present species.

The generic name *Stylastræa* was proposed by Lonsdale in 1845, for a fossil coral from the Carboniferous rocks of Russia. The type of the genus, which Lonsdale described and figured under the name *S. inconferta*, has since been pronounced to be a *Lithostrotion*, by D'Orbigny, in the "Prodrome de Paléontologie," published in 1850, and by Edwards and Haime in the "Polypiers Fossiles des Terrains Palæozoiques," published in 1851. Morris, in the second edition of his "Catalogue of British Fossils" (1854), Lindström, in his "Index to the genera of Palæozoic Corals" (Stockholm, 1883), and Etheridge, in the first volume of his "Fossils of the British Islands" (1888), also make *Stylastræa*, Lonsdale, a synonym of *Lithostrotion*, though Zittel, in the first volume of his "Handbuch der Palæontologie (1876-80), regards it as a synonym of *Diphyphyllum*, but uses the name *Stylastræa*, Fromentel, for a Liassic genus of corals belonging to the *Astræaceæ*.

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* Dr. Frech thinks that the *Cyathophyllum arcticum* of Meek, from the Devonian rocks of Alaska and the Mackenzie River district, is synonymous with this species, as suggested by the writer on page 199 of the present volume.

Although they agree perfectly with Professor Whitfield's description and figures of the coral from the Devonian rocks of Ohio which he calls *Stylastræa Anna*, it yet seems to the writer that the specimens collected by Dr. Bell and Mr. Tyrrell are referable to *Cyathophyllum* rather than to *Stylastræa*, and that they are very nearly related to the *C. rugosum* of Hall. From the last named species they seem to differ only in the circumstance that their septa only reach about half way to the centre and that they are not continued, as carinations, on the upper surface of the tabulæ.

(S.) CYATHOPHYLLUM PROFUNDUM, Hall. (Sp.)

Acervularia profunda, Hall. 1858. Rep. Geol. Surv. Iowa, vol. I, pt. 2, p. 477, pl. i, figs. 7a b, c.

"Western shore of Dawson Bay, from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874 : two or three specimens in which the internal structure of the corallites is beautifully preserved. These were identified with the present species by E. Billings, on page 68 of the Report of Progress of this Survey for 1874-75.

Since then, precisely similar specimens have been collected "in place" by J. B. Tyrrell, at Lake Manitoba, on the east side of the Narrows, in 1888, and by Messrs. Tyrrell and Dowling, at Lake Winnipegosis, on three islands in the southern part of Dawson Bay, and on the Red Deer River at the Lower Salt Spring, in 1889. In each of these, the average maximum diameter of the adult corallites is from thirteen to fifteen millimetres, and the number of their septa from thirty eight to forty.* Some of the septa extend to the centre and others not quite so far, but these latter are of varying length and do not regularly alternate with the former. There are no tabulæ, the spaces between the septa being filled with vesicular tissue, the general direction of the vesicles being upward and outward.

According to Dr. Rominger, † "the corals described under the name

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* Prof. Hall says that there are from forty one to forty six septa in full grown individuals of his *Acervularia profunda*.

† Geol. Surv. Michigan, Fossil Corals, p. 106.

Acervularia Davidsoni and *Acerv. profunda*, which latter," he considers "merely as a variety of the former, are in structure identical with *Cyathophyllum rugosum*." "The genus *Acervularia* is represented as having its central portion of the polyp cells surrounded by an internal wall, but neither the above-mentioned corals nor the typical forms of the genus *Acervularia* (*Cyath. pentagonum* and *Cyath. ananas* of Goldfuss) exhibit an internal wall. In the circumference of theabrupt inner cell-pits of all these forms a sort of annular demarkation is conspicuous in transverse sections, because the shorter ones of the alternately larger and smaller radial lamellæ terminate there with somewhat thickened edges, but they never combine into a closed, ring-like wall." While following Dr. Rominger in regarding *Acervularia profunda* as a *Cyathophyllum*, and Dr. Frech, who has seen the specimens collected by Messrs. Tyrrell and Dowling, in referring them to the group of *C. hexagonum*, it is thought desirable to retain Hall's specific name for these specimens, as they correspond much better with his description and figures of *A. profunda* than with those of *A. Davidsoni.*

CYATHOPHYLLUM PROFUNDUM. (Var.)

Plate 34, figs. 4 and 4a.

Corallum large, composite, massive, in the only specimen known to the writer depressed subsphærical : corallites polygonal or rounded polygonal, intimately united throughout their length, and separated only by a single and extremely thin wall, unequal in size, the adult ones averaging from seventeen to nineteen millimetres in their maximum diameter. Calyces shallowly concaveexternally, the abruptly and not very deeply excavated central portion occupying rather more than one-half of the entire diameter of each corallite ; septa as many as fifty four in number in the largest corallites ; at the bottom of the cup and below it many of the septa reach to the centre, the others being shorter but very unequal in length. Internal structure, as shown in longitudinal sections, consisting of fine vesicular tissue between the septa, their being no tabulæ nor arched carinæ.

South end of Snake Island, Lake Winnipegosis, J. B. Tyrrell, 1889 : a single colony, about six inches in length, five in breadth and two and a half in height, a portion of which is figured. The specimen seems to indicate or represent a local variety of *C. profundum*, in which the adult corallites are larger, their septa more numerous and the interseptal vesicles proportionately smaller and more numerous than those of the typical form. Dr. Frech thinks that the specimen is very nearly related to the *C. hypocrateriforme* of Goldfuss.

Group of *Cyathophyllum (Blothrophyllum) decorticatum*, Billings.

CYATHOPHYLLUM ATHABASCENSE. (Var.)

Plate 34, figs. 8 and 8a.

Cyathophyllum Athabascense, Whiteaves. 1891. This volume, p. 202, pl. xxxii, figs. 1, 1a, b.

Lake Winnipegosis, on the south western shore of Cameron Bay, J. B. Tyrrell, 1889: a single and perfect specimen, which appears to be a mere variety of this species. It differs from the types from the Devonian rocks of the Athabasca River only in having its central area occupied by flexuous, irregularly disposed but for the most part continuous tabulæ, rather than by large interseptal dissepiments, and in its narrower vesiculose peripheral zone, the inner margin of which is more clearly defined.

(S.) COLUMNARIA (CYATHOPHYLLOIDES) DISJUNCTA. (N. Sp.)

Plate 34, figs. 3, 3a and 3b.

Corallum composite, consisting apparently of a colony of cylindrical, straight or flexuous, ascending or erect corallites, which are separate but sometimes partially in contact, and more or less closely aggregated: diameter of the corallites averaging about five millimetres, their mural investment single and external. Surface markings of the corallites unknown, though in transverse sections there are indications of longitudinal ribs corresponding to the septa within. Calyces deep, with erect sides: primary septa thirteen, simple, neither crenulated nor denticulated, very thin, laminar and extending to the centre at and below the bottom of the cup: secondary septa similar in number and structure to the primaries, but reaching only half way to the centre. The only internal structures, besides the septa, are rather distant, thin and laminar horizontal diaphragms, which partake partly of the nature of tabulæ and partly of dissepiments. These diaphragms either form almost continuous floors across the corallites (at intervals of from one to two millimetres apart) and thus resemble tabulæ, except that their continuity appears to be interrupted by the septa, or they are disconnected and not on the same plane and thus partake more of the nature of dissepiments, though they are never curved.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888. South-west shore of Dawson Bay, Lake Winnipegosis, at the mouth of Steep Rock River, J. B. Tyrrell, 1889. At each of these localities a few comparatively large portions of a single colony were collected, in which the corallites are everywhere surrounded by hard compact dolomite, though their interior is quite free from the matrix. The specimens present good longitudinal and transverse sections of the corallites, which show the internal structure of the latter admirably, but the surface markings of the corallites are nowhere visible, and the exact mode of growth of the whole corallum is uncertain.

This species differs from the typical forms of *Columnaria* in its cylindrical, separate, and probably fasciculated corallites, and belongs to an aberrant section of that genus, for which Dybowski has proposed the name *Cyathophylloides.* It is clearly congeneric, and may even prove to be conspecific, with the *Cyathophylloides Rhenanum* of Frech, from the Devonian rocks of the Eifel, which Dr. Frech informs the present writer is also a *Columnaria.* Around Lakes Manitoba and Winnipegosis, too, *C. disjuncta* has, so far, been found invariably associated with *Stringocephalus Burtini,* as *C. Rhenanum* is at Paffrath.

(S.) AMPLEXUS, or DIPHYPHYLLUM. (Sp.)

Plate 35, figs. 2 and 2a.

A number of fragmentary specimens of a species of *Amplexus*, *Pycnostylus* or *Diphyphyllum* were collected by Mr. Dowling in 1889, on the western shore of Dawson Bay, on two small points, one two miles and a half and the other four miles and a half north of the mouth of the Red Deer River. These specimens do not show conclusively whether the entire corallum was originally composite or simple, the surface markings are unknown, as are also the characters of the calyces. On the other hand, the internal structure of the corallites (or corallum) is well preserved and clearly shown in numerous natural sections. The specimens consist of straight or flexuous cylindrical tubes, which average about five millimetres in length, are imperfect at both ends and imbedded in compact or vesicular dolomite. The interior of these tubes is composed of a very narrow outer or peripheral and septate zone and of a broad central tabulate area. The outer zone appears to be bounded internally by an inner wall. The septa, which are equal in length and thirty two in number, all extend from the outer to the supposed inner wall, and terminate on the inner surface of the latter, in some cases as continuous and slightly raised longitudinal ridges, in others as linear rows of minute tubercles, both modifications being observable in the same tube. The interseptal spaces between the outer and inner wall are traversed by small dissepiments. In the central tabulate area, which occupies about four fifths of the entire diameter, the tabulæ are for the most part flexuous and irregular in their shape and disposition, the distances between them varying from half a millimetre to two millimetres. Most of the tabulæ are complete and stretch completely across from one side of the inner wall to the other, but they sometimes inosculate and occasionally one or two incomplete ones are intercalated between two of the others.

Dr. Frech, who has examined the specimens collected by Mr. Dowling, is of the opinion that they belong to the genus *Amplexus* and that they are nearly related to the *A. Hercynicus* of A. Römer, from the Stringocephalus limestone of Germany. Dr. Frech thinks that the supposed inner wall of the tubes, represented on Plate 35, fig. 2a, is caused by the cutting of the curved tabulæ. On the other hand, there are clearly dissepiments between the specimens from Dawson Bay, which are stated to be wanting in *Amplexus*, and there is a remarkably close resemblance, in size, shape and internal structure, between these specimens and the *Diphyphyllum stramineum* of Billings, which Dr. Rominger says is both congeneric and conspecific with the *Eridophyllum Simcoense* of the same author, and which therefore should be called *D. Simcoense.* In the actual types of *D. stramineum*, however, the central area of the corallites is not separated from the peripheral cycle by an internal wall (as pointed out by Dr. Rominger), the septa are unequal in length and extend much farther inward than do those of the Dawson Bay specimens, and the tabulæ are straighter and more regular in their disposition.

(S.) ACTINOCYSTIS VARIABILIS. (N. Sp.)

Plate 35, figs. 3 and 3a.

Corallum simple, slightly curved, varying in shape from broadly turbinate and widely expanding, with the breadth at the summit exceeding the height, to cylindro-conical and somewhat contracted at the summit; outer surface apparently almost smooth and marked only with a few transverse wrinkles; calyx rather deep, conical, narrow at the base; septa about eighty five in number, extending from the exterior to within a short distance from the centre, but feebly developed, thin, and rarely, if ever, quite straight, their regularity being frequently disturbed by anchylosis with the walls of the interseptal vesicles. Internal structure, apart from the septa, essentially the same as that of *Cystiphyllum*, and consisting exclusively of coarse vesicular tissue. The vesicles are very large in the central area and diminish gradually in size towards the periphery. As viewed in longitudinal sections, they appear as lenticular cells which radiate obliquely upward and outward from the centre of the coral.

"Western shore of Dawson Bay," Lake Winnipegosis, "from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874: one small specimen, which was referred to by E. Billings as a "*Heliophyllum* (like *H. Halli*)", and which bears a considerable resemblance to that species externally, though its internal structure has since been found to be quite different.

South-east shore of Lake Winnipegosis, a few miles north of Point Brabant, and west shore of the same lake, at a small point north-west of Fox Point, J. B. Tyrrell, 1889 : one specimen from each of these localities. South-east shore of Dawson Bay, Lake Winnipegosis, at Whiteaves Point (two specimens), and on a small island two miles west of this point (one specimen) ; J. B. Tyrrell, 1889. West side of Dawson Bay, at the south end of Rowan Island, D. B. Dowling, 1889 : one specimen.

(S.) FAVOSITES GOTHLANDICA, Lamarck. (Var.)

Cfr. *Favosites Billingsii*, Rominger. 1876. Geol. Surv. Mich., Foss. Corals, p. 28.
Favosites Gothlandica, var. *Billingsii*, Nicholson. 1879. Tab. Cor. Palæoz. Per., p. 55, pl. 1, fig. 6.

Cfr. also *Favosites Hamiltoniæ*, Hall. 1876. Illustr. Devon. Foss., pl. xxxiv, figs. 1-9.

Western shore of Dawson Bay, Lake Winnipegosis, Dr. J. W. Spencer, 1874 : one *loose* and imperfect specimen.

Lake Manitoba, at Monroe and Pentamerus Points, J. B. Tyrrell and J. F. Whiteaves, 1888. Dawson Bay, Lake Winnipegosis ; on the south-east side at Whiteaves Point ; on four small islands at the south and south-east end of the bay ; also on the south-west side, about five miles south of Salt Point, and on a small point east of Steep Rock River ; J. B. Tyrrell, 1889. A few specimens, which seem to be intermediate in their characters between the typical *F. Gothlandica* and the var. *Billingsii*, and which can scarcely be distinguished from the *F. Hamiltoniæ* of Hall, were collected at each of these localities.

Most of the specimens are well preserved portions of large colonies, but one large and nearly perfect example is a depressed expansion of irregular form, which measures about eleven inches in length, seven inches and a half in breadth and five inches in height. In each specimen the corallites are polygonal (not rounded polygonal) and most of them are nearly equal in size, their average diameter being about three millimetres. The septa are represented by rather short, rounded and apparently very fragile spines, which are usually broken off. The mural pores are disposed in one or two (rarely three) longitudinal rows on each of the prismatic faces of the corallites, and where there are two rows the pores are sometimes alternate and at others opposite. The tabulæ are complete, continuous and rather regularly disposed, but they do not show the "marginal punctiform depressions" which Dr. Rominger describes as one of the characters of *F. Billingsii*.

(S.) PACHYPORA CERVICORNIS, DeBlainville. (Sp.)

For a list of the synonyms of this species, with references, see page 206 of the present volume.

Lake Manitoba, on the east side of the narrows, near Manitoba Island; on the north-west side, at Big Sandy Point, Monroe, Pentamerus and Onion Points; and on the north-east side, north of Steep Rock Point, J. B. Tyrrell and J. F. Whiteaves, 1888: more or less abundant at each of these localities.

Dawson Bay, Lake Winnipegosis, on five small islands at the south end or south-east side, also on its western shore at five localities between the mouths of the Steep Rock and Red Deer Rivers, and on two small points immediately north of the Red Deer River, J. B. Tyrrell and D. B. Dowling, 1889: a few specimens from each of these localities.

PACHYPORA, or ALVEOLITES. (Sp. Undet.)

Red Deer River, at the Upper Salt Spring, and about five miles from Lake Winnipegosis, D. B. Dowling, 1888: two specimens, but obtained abundantly on the same river, at the Upper and Lower Salt springs, by J. B. Tyrrell in 1889. A few specimens also were collected by Mr. Tyrrell in 1889 at several localities in the southern portion of Lake Winnipegosis, as at the south end of Snake Island, the north side of South Manitou Island and Point Brabant, also at two localities on the south-west side of Dawson Bay.

The specimens from these localities consist of rather small or medium sized corals, with much the same general shape and proportions as *Pachypora polymorpha.* The stems are cylindrical, widely and doubly bifurcating, with an average diameter of about eight or nine millimetres in the thickest part. The corallum in each seems to differ from that of *P. polymorpha* in the much greater obliquity with which its corallites open outward to the surface; also, in the circumstance that their apertures are frequently transversely semielliptical, semilunar, or sub-triangular, and broader than high, with the lower lip of each distinctly projecting. In most respects, these specimens agree remarkably well with the published descriptions and figures of *Alveolites cryptodens*, Billings, and even with the types of that species in the Museum of the Survey, but the throats of their corallites are almost invariably filled with dolomite, and shew no traces of the three internal ridges or "longitudinal crests" which are so characteristic of *A. cryptodens.*

(S.) ALVEOLITES VALLORUM, Meek.

Alveolites vallorum, Meek. 1868. Trans. Chicago Ac. Sc., vol. I., p. 86, pl. xi, fig. 9.
" " Rominger. 1876. Geol. Surv. Michigan, Foss. Corals, p. 41, pl. xvii, fig. 3.

Lake Winnipegosis, from the basal beds of the Upper Devonian at the north end of Snake Island (one specimen); also, from the Stringocephalus zone at three localities on the south-west side of Dawson Bay (two or three specimens from each), and on three small islands in the southern portion of Dawson Bay (a few specimens from each); J. B. Tyrrell, 1889.

The specimens of *A. vallorum* from the Hay, Mackenzie and Peace Rivers referred to on page 207, have the outer surface of the corallum well preserved, but the structure of the interior of the corallites is more or less obliterated by crystallization, the corallites being completely filled with matrix. In the specimens from Lake Winnipegosis, however, which do not occur in shale, but in a compact or vesicular dolomite, the exterior of the corallum is not so well preserved, but the corallites are nearly free from the matrix throughout their length. The corallites are laterally compressed, and their apertures vary in outline from narrowly elongated or somewhat crescentic to polygonal, and in their greatest diameter from half a millimetre to a millimetre and a half. The septal spines are well developed, but apparently very fragile. As many as from six to eight rows of these can be counted, though with difficulty, but there do not appear to be ever as many as twelve rows, as there are said to be in *A. squamosus*. The tabulæ are complete and ofter rather regularly disposed. Of the lateral or marginal mural pores, about ten can be counted in the space of five millimetres.

HYDROMEDUSÆ.

HYDROIDA.

(S.) STROMATOPORA. Sp.

(Cfr. *Stromatopora Bücheliensis*, Bargatzky, sp.)

Caunopora Bücheliensis, Bargatzky. 1881. Die Stromatoporen des Rheinschen Devons, p. 62.
Stromatopora Bücheliensis, Nicholson. 1886. Mon. Brit. Stromatoporoids, Pt. I, p. 23, pl. x, figs. 5-7.
" " Nicholson. 1891. Ib., Pt. III., p. 186, pl. xxiii, figs. 4-7.

Lake Winnipegosis, on two small islands in Dawson Bay, one on the south-east side of the bay, and the other at its southern end, J. B. Tyrrell, 1889: a single specimen from each island.

The whole of the Stromatoporoids collected by Messrs. Tyrrell and Dowling in 1888 and 1889, from the Devonian rocks of Lakes Manitoba and Winnipegosis, were sent (in January, 1890) to Prof. H. A. Nicholson, who has since reported on them in a paper published in the "Annals and Magazine of Natural History" (London, England) for April, 1891. According to Prof. Nicholson, on page 313 of this paper, these two specimens in particular "have the general aspect of *Stromatopora Büchelіensis*, Barg., sp., and are probably referable to this species. Unfortunately, the specimens in question are dolomitized, and their internal structure is so far altered that this reference cannot be regarded as free from doubt."

STROMATOPORA. Sp.

(Cfr. *Stromatopora Hüpschii*, Bargatzky, sp.)

Caunopora Hüpschii, Bargatzky. 1881. Die Stromatoporen des Rheinischen Devons, p. 61.

Stromatopora Hüpschii, Nicholson. 1886. Mon. Brit. Stromatoporoids, Pt. I, p. 50, figs. 6 a, b, and pl. x., figs. 8 and 9; also Ib., Pt. III. (1891), p. 176 (which see for a complete list of the synonyms of this species, with references), pl. xxii., figs. 3-7.

Lake Winnipegosis, at the south end of Snake Island (one specimen), and on a small island on the south-east side of Dawson Bay (one specimen); J. B. Tyrrell, 1889.

In reference to these two specimens Dr. Nicholson writes (op. cit., p. 314) that they "belong to a species of *Stromatopora* in many respects similar to *S. Hüpschii*, Barg. Structurally these specimens agree with the latter common European and British type, and differ from *S. Bücheliensis*, Barg., in their coarse skeleton-fibre, the lax reticulation of the skeleton, and the loose spreading form of the astrorhizæ. The internal structure of these specimens is, however, very poorly preserved, and it would be rash to refer them unreservedly to *S. Hüpschii.*"

A single specimen of a Stromatoporoid collected by Dr. R. Bell in 1877, at the Long Portage of the Missinaibi River, is also doubtfully referred by Prof. Nicholson to *S. Hüpschii*.

(S.) ACTINOSTROMA EXPANSUM, Hall and Whitfield. (Sp.)

Stromatopora expansa, Hall and Whitfield. 1873. Twenty-third Reg. Rep. N. York St. Cab. Nat. Hist., p. 226, pl. ix., fig 9.

Actinostroma expansum, Nicholson. 1891. Ann. and Mag. Nat. Hist. vol. VII., sixth series, p. 316, pl. x, figs. 1 and 2.

Lake Winnipegosis, at a small island on the south-east side of Dawson Bay, J. B. Tyrrell, 1889: two specimens.

(S.) ACTINOSTROMA TYRRELLII, Nicholson.

Actinostroma Tyrrellii, Nicholson. 1891. Ann. and Mag. Nat. Hist., vol. VII, sixth series, p. 317, pl. viii, figs. 4 and 5, and wood cut, fig. 1.

Lake Winnipegosis, at five localities on the shore and islands of the southern portion of Dawson Bay, J. B. Tyrrell and D. B. Dowling, 1889; apparently not uncommon and in fine condition at each of these localities.

(S.) ACTINOSTROMA FENESTRATUM, Nicholson.

Actinostroma fenestratum, Nicholson. 1889. Mon. Brit. Stromatoporoids, Pt. II, p. 146, pl. xvii, figs. 8 and 9.
" " Nicholson. 1891. Ann. and Mag. Nat. Hist., vol. VII, sixth series, p. 322, pl. x, figs. 3 and 4.

Lake Manitoba, north-west side, at Pentamerus Point, three miles and a half north of the mouth of Crane River, J. B. Tyrrell and J. F. Whiteaves: several specimens. Lake Winnipegosis, on two small islands at the southern end of Dawson Bay; also on the south-western shore of Dawson Bay, a little to the west of Salt Point, and at the south end of Rowan Island, in the western portion of the bay, J. B. Tyrrell, 1889: one specimen at each locality.

ECHINODERMATA.

CRINOIDEA.

(S.) CTENOCRINUS. (Sp.)

Cfr. *Ctenocrinus decadactylus*, (Goldf. sp.) G. and F. Sandberger. 1850-56. Die Versteiner. des Rheinischen syst. in Nassau, p. 396, pl. xxxv, fig. 15.
Cfr. also, *Ctenocrinus typus*, (Bronn.) Zittel. Handbuch der Palæontologie, vol. I, p. 372, fig. 260.

Although portions of the stems of crinoids are not infrequent in the Devonian rocks of Lakes Manitoba and Winnipegosis, only two specimens have as yet been obtained in which any portion of the calyx or dorsal cup is preserved. These were collected by Mr. Tyrrell in 1889, one on a small island on the east side of Dawson Bay and the other on a small island at the south end of the bay. The more perfect of these two specimens has ten of the calycinal plates preserved and not quite two inches of the column. Each of these calycinal plates is hexagonal, slightly convex externally, smooth in the centre, but crenulated round the margin. The column is thick, averaging about seventeen millimetres, or about three quarters of an inch, in diameter, circular and annulated, with one or two flat articulations usually alternating with a single raised and moderately prominent one. In some portions of columns, however, from the same localities, the raised articulations bear rounded and much elevated tubercles. Both of the specimens are far too fragmentary to be identified, even generically, but they bear a striking resemblance to the *C. decadactylus*, as figured by the Sandbergers, and to the *C. typus*, as figured by Zittel, though some palæontologists regard *Ctenocrinus* as synonymous with *Melocrinus*.

VERMES.

SPIRORBIS OMPHALODES, Goldfuss.

Serpula omphalodes, Goldfuss. 1826-33. Petref. Germ., vol. I, p. 235, pl. lxvii, fig. 3.
Spirorbis omphalodes, Nicholson. 1874. Rep. Palæont. Prov. Ont., p. 121, fig. 54a.
" " Whiteaves. 1891. This volume, p. 209, pl. xxviii, figs. 3, 4, 4a, 5, and 5a.

Dawson Bay, Lake Winnipegosis, at a small island on the east side (one specimen on a piece of a crinoidal column), and at Point Wilkins, on the south-west side (several examples, attached to the shells of brachiopoda); also on the Red Deer River, at the Upper Salt Spring, five miles from Dawson Bay (one specimen on a simple *Cyathophyllum*); J. B. Tyrrell, 1889.

At each of these localities the specimens are rather more closely coiled and consequently more narrowly umbilicated than the types described by Goldfuss, but they agree very well with Ferdinand Roemer's figures of *S. omphalodes*, on plate xxxi of the Atlas to the first volume of the *Lethæa Geognostica*.

POLYZOA.

LEPTOTRYPA QUADRANGULARIS, Nicholson. (Sp.)

Chætetes quadrangularis, Nicholson. 1874. Geol. Mag., N. Ser., Dec. 2, vol. I, p. 58, and Rep. Palæont. Prov. Ont., p. 61, fig. 18.
Paleschara quadrangularis, S. A. Miller. 1889. N. Am. Geol. & Palæont., p. 177 (under *Chætetes*).
" " Whiteaves. 1891. This volume, p. 213.
Leptotrypa quadrangularis, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII, p. 455.

Red Deer River, half a mile above the Lower Salt Spring and about two or three miles from Dawson Bay, J. B. Tyrrell, 1889: one specimen attached to a valve of *Atrypa reticularis*.

PINACOTRYPA MARGINATA. (N. SP.)

Plate 36, figs. 1, 1a & 1b.

Zoarium explanate, forming thin, flattened or flexuous, subcircular expansions, from three quarters of an inch to an inch in their maximum diameter. Under surface covered with an extremely thin laminar epitheca: upper surface consisting of a broad central celluliferous area, surrounded by a projecting lateral expansion of the epitheca, which is entirely devoid of cells. Celluliferous area marked with large star-shaped maculæ, whose centres are about six mm. apart. Outer and noncelluliferous expansion variable in breadth, its upper surface marked by longitudinal and nearly parallel raised lines of unequal size, which in some specimens are interwoven with a few similar but concentric lines. Zoœcia (or autopores) at first recumbent but ultimately erect, very short, cylindrical, about a third of a millimetre broad at their summits, arranged in subparallel lines which radiate from the maculæ, but very closely disposed, and in some cases almost touching each other: orifices of the zoœcia frequently closed by flat opercula, and surrounded in each case by a thin, slightly elevated and apparently granulose peristome. Interspaces very narrow, occupied by a single series of polygonal interstitial cells or mesopores (over whose apertures a thin smooth calcareous membrane or " roof " is usually stretched) except on the maculæ, where they are disposed in small clusters. Lunarium nearly or quite obsolete. Microscopic sections show that the interstitial cells or mesopores are comparatively large, and placed one over the other, even in the maculæ, so as to form tabulated tubes, and not vesicular tissue as in *Fistulipora.*

Lake Winnipegosis, at a small island on the south-east side of Dawson Bay, J. B. Tyrrell, 1889: seven specimens. Also on a small island on the east side of Lake Winnipegosis and east of the south end of Birch Island, J. B. Tyrrell, 1889; two specimens, loose.

This species is referred to *Pinacotrypa* rather than to *Fistulipora* or *Lichenalia*, on the authority of Mr. E. O. Ulrich, who, in a letter to the present writer, dated 23rd September, 1891, makes the following remarks on two of the best specimens collected by Mr. Tyrrell, which were sent to him for examination: "This is a remarkable form which I think may be safely described as a new species of *Pinacotrypa.* The general expression of the surface is much as in several species of *Fistulipora*, but the constant nummiform shape is distinctive. The chief peculiarity, however, is the longitudinal striation of the basal lamina. This is a very remarkable feature, and one quite unknown to me. The cells are smaller and the maculæ more distinct than in *P. elegans*, the *Fistulipora elegans* of Rominger."

(S.) CYSTODICTYA HAMILTONENSIS, Ulrich.

Plate 36, figs 2, 2a and 2b.

Cystodictya Hamiltonensis, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII, p. 493, pl. xlii, fig. 4, and pl. xliii, fig. 1.

Monroe Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 : seven specimens. Lake Winnipegosis, at a small island on the east side of Dawson Bay, D. B. Dowling, 1888 : three specimens. The species has since been collected by Messrs. Tyrrell and Dowling in 1889, on the east side of Dawson Bay, at Whiteaves Point, and on three small islands adjacent thereto, on the west side, at Rowan Island, also *(loose)* on the east side of Lake Winnipegosis at a small island east of the south end of Birch Island.

The specimens from these localities were first identified with this species by Mr. L. M. Lambe.

(S.) FENESTELLA VERA, Ulrich.

Plate 36, figs. 3 and 3a.

Fenestella vera, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII, p. 535, pl. xliv, figs. 1 and 1a, and pl. liv, fig. 3.

Dawson Bay, on two small islands near Whiteaves Point, three specimens on one of these islands, and one specimen on the other ; also on the east side of Lake Winnipegosis, at a small island east of the southern extremity of Birch Island (a small fragment); J. B. Tyrrell, 1889.

These specimens agree very well with Mr. Ulrich's description and figures of *F. vera*, but they are not sufficiently well preserved to show the "very minutely granulose" surface of "both branches and dissepiments," said to be characteristic of that species. Only the outer or non-celluliferous side is exposed in any of these specimens, but the shape, number and disposition of the zoœcia has been clearly ascertained by scraping away small portions of the exterior. The identifications of the specimens here referred to this and to the preceding species have been verified by Mr. Ulrich.

(S.) FENESTELLA, Sp.

(Cfr. *Fenestella dispanda*, Hall.)

Plate 36, fig. 4.

Fenestella dispandus, Hall. 1886. Rep. St. Geol. for 1885, adv. sheets, Expl., pl. xliv, figs. 1-4.

Fenestella dispanda, Hall. 1887. Pal. N. York, vol. VI, p. 114, pl. xliv, figs. 1-4.

Dawson Bay, Lake Winnipegosis, on the south-east side, at Whiteaves Point (two specimens) and on the west side, at the south end of Rowan Island, also on the east side of Lake Winnipegosis at a small island opposite Birch Island, three specimens ; J. B. Tyrrell and D. B. Dowling, 1889.

The specimens from these localities agree fairly well with Hall's figures of *F. dispanda*, but their identication with that species is doubtful, owing to the contradictory nature of the measurements given in its description. They differ from the specimens here referred to *F. vera*, in their straggling mode of growth, striated noncelluliferous surface, large oblong fenestrules, and in their more slender branches and dissepiments.

(S.) POLYPORA (POROSA ? var.) MANITOBENSIS.

Plate 36, fig. 5.

Cfr. Fenestella porosa, Hall. 1881. Trans. Albany Inst., vol. X, abstract, p. 26.
Fenestella (Polypora) porosa, Hall. 1883. Rep. St. Geol. for 1882, Expl., pl. 31, figs. 1-6.
" " " " 1887. Pal. St. N. York, vol. VI, p. 163, pl. xxxviii, figs. 1-6.

Zoarium infundibuliform, rather widely expanding, irregularly and shallowly undulated. Branches slender, usually zigzag when the fenestrules are alternate, but occasionally straight where they are opposite and appearing externally, on the noncelluliferous side, as smooth (?) slightly angular longitudinal ridges, which are a little broader than the transverse noncelluliferous dissepiments. Fenestrules large, a little longer than wide, elliptical or approaching to hexagonal in outline and averaging about ·8 mm. in length and ·6 mm. in width. In a distance of six millimetres there are four fenestrules as measured longitudinally, and six as measured transversely. Cell apertures disposed in from two to four alternating longitudinal rows, about four of these apertures in each row to the length of a fenestrule.

Monroe Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 : four specimens. Dawson Bay, Lake Winnipegosis, on three small islands, two on the south-east side and the other in the southern portion of the bay, also on its eastern shore, at the second point north of the mouth of the Red Deer River, J. B. Tyrrell and D. B. Dowling, 1889 : a few specimens from each of these localities.

In each of these it is only the noncelluliferous outer surface that is exposed, the characters of the zoœcia having been ascertained by scraping down small portions of the branches. The close affinity of these specimens to the *P. porosa* of Hall was suggested to the writer by Mr. Ulrich.

From that species they appear to differ principally in their much more slender branches and dissepiments, more hexagonal fenestrules, and in the greater extent to which the arrangement of the zoœcia in two rows prevails.

BRACHIOPODA.

(S.) DISCINA. (Sp. Indet.)

Western shore of Dawson Bay, at the first small point north of the mouth of the Red Deer River, D. B. Dowling, 1889 : two casts of the upper valve, which are too badly preserved to admit of determination or accurate description. Both are small and nearly circular in basal outline, with a depressed apex, which is nearly central in one of the specimens and slightly excentric in the other.

CHONETES LOGANI, var. AURORA, Hall.

Chonetes Logani, var *Aurora*, Hall. Pal. St. N. York, vol. IV, pt, 1, p. 137, pl. xxii, figs. 16-28.
" " " Williams. 1880. Bull. Geol. Surv. Am., vol., I, pp. 490 and 491, pl. xii, figs. 10 and 11.
" " " Whiteaves. 1891. This volume, p. 215, pl. xxix, figs. 2 and 2a.

Red Deer River, half a mile above the Lower Salt Spring, J. B. Tyrrell, 1889 : abundant.

CHONETES MANITOBENSIS. (N. Sp.)

Plate 37, figs. 1, 1a and 2.

Shell small, concavo-convex, strongly compressed, transversely semielliptical, about twice as broad as long and broadest at the hinge line : cardinal extremities angular and very slightly produced : sides rounded in front : anterior margin nearly straight or but faintly convex in the centre. Ventral valve compressed convex, its cardinal border armed on each side of the beak with three or four slender and widely divaricating spines, which increase in length outward : its beak inconspicuous, minute and not projecting, its hinge area narrow, with a small triangular fissure. Dorsal valve shallowly concave, its beak minute and its hinge area narrower than that of the ventral.

Surface marked with very minute radiating raised lines, which increase in number at variable distances from the beaks, by bifurcation, trifurcation or intercalation, so that around the outer margin as many as from seventy to a hundred can be counted under a lens. In addition to these, the exterior of well preserved specimens is marked with exceedingly fine and close-set, concentric raised lines. Interior of the valves minutely papillose. Muscular impressions unknown.

The dimensions of two average specimens are as follows: of one, maximum length nearly ten millimetres, greatest breadth, nineteen; of another, length ten mm. and a quarter, breadth twenty.

Rather abundant at the north end of Manitoba Island, in Lake Manitoba, where it was collected by Prof. H. Y. Hind in 1858 and by J. B. Tyrrell and the present writer in 1888.

This small *Chonetes* seems to differ from the *C. carinata* (or *coronata*) of Conrad, as described and figured by Prof. Hall in the fourth volume of the Palæontology of the State of New York, in its uniformly smaller size, flatter and more transversely elongated valves, finer sculpture and in the greater length and smaller number of the spines on the cardinal margin of the ventral valve. According to Prof. Hall, a careful measureof the radiating striæ on numerous specimens of *C. carinata* from the State of New York "shows that they range from nine to fifteen striæ in the space of two tenths of an inch," while specimens from Illinois gave from nine to twelve in the same space. In three average examples of *C. Manitobensis*, from twenty to twenty two radiating raised lines were counted in a corresponding space.

C. Manitobensis is also very closely allied to the *C. striatella* of Dalman, from the Silurian (Upper Silurian) of Europe, and to the *C. Hardrensis* of Phillips, from the English Devonian. Of the former it may prove to be a local and stratigraphical variety, and from the latter (as described by Davidson) it seems to differ chiefly in the circumstance that its radiating "striæ" are not minutely spinose.

(S.) PRODUCTELLA PRODUCTOIDES, var. MEMBRANACEA.

Leptæna membranacea, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somerset, p. 60, pl. xxv, fig. 101.

Strophalosia productoides, (Murchison, 1840) Davidson. 1865. Mon. Brit. Dev. Brach., p. 97, pl. xix, figs. 18–21; also, this volume, p. 216, pl. xvi, figs. 1 and 2.

Monroe Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: six specimens.

In the first part of the eighth volume of the Palæontology of the State of New York, just published, (p. 317) Professor Hall follows Professor King in referring the typical form of this species to *Productella* rather than to *Strophalosia*, and this view has been adopted here, as equally applicable to the var. *membranacea*.

PRODUCTELLA SUBACULEATA, Murchison. (Sp.)

Productus subaculeatus, Murchison. 1840. Bull. Soc. Géol. de France, vol. XI, p. 255, pl. ii, fig. 9.

Leptœna fragaria, J. de C. Sowerby. 1840. Tran. Geol. Soc. Lond., 2nd. ser.,.vol. V, p. 704, pl. lvi, fig. 5.

" " Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somerset, p. 59, pl. xxv, fig. 100.

Productus subaculeatus, Davidson. 1865. Mon. Brit. Dev. Brach., p. 99, (which see for a full list of references to European publications in which this species is described or referred to) pl. xx, figs. 1 and 2.

Productella subaculeata, Hall. 1867. Pal. St. N. York, vol. IV, p. 154, pl. xxiii, figs. 4 and 5.

A few specimens of this well known European species were collected at each of the following localities. North end of Manitoba Island and Onion Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888. At twelve localities on Lake Winnipegosis; i. e., at the south end, on Snake and another small island; on the south-west side, at PointBrabant; on the north-west side, at Devils Point and in Cameron Bay; also on the shore and islands of the south-eastern, southern and south-western portions of Dawson Bay: J. B. Tyrrell, 1889. Red Deer River near and between the Upper and Lower Salt springs, and Hog Island in Swan Lake, Manitoba: J. B. Tyrrell and D. B. Dowling, 1889.

ORTHIS (SCHIZOPHORIA) STRIATULA, Schlotheim.

For a list of synonyms of this species, with references, see page 218 of the present volume.

Snake Island, Lake Winnipegosis, Prof. H. Y. Hind, 1858: Upper Salt Spring, Red Deer River, Prof. Macoun, 1881.

ORTHIS (SCHIZOPHORIA) MANITOBENSIS. (Nom. prov.)

Plate 37, figs. 3, 3 a, 4, 5 and 5 a.

Shell rather small, resupinate, transversely subelliptical or subquadrangular, a little broader than long: thickness through the closed valves about one third less than their maximum breadth: hinge area a little more than one half of the entire breadth; front margin rather deeply sinuated in the centre. Ventral valve much flatter than the dorsal, with a concave sinus at and near the front margin, its hinge area apparently broader in the direction of its height than that of the dorsal, and its beak prominent but nearly straight. Dorsal valve strongly convex, its umbonal and central region tumid, its umbo rather prominent, and its beak incurved and slightly recurved.

Surface markings consisting of fine, subequal and closely disposed, radiating raised lines, which increase in number by bifurcation, trifurcation and intercalation, and are crossed by a few irregularly disposed, but for the most part distant, concentric striæ of growth. Around the outer margin of the dorsal valve figured (fig. 3), about 136 radiating raised lines can be counted, and in a still larger dorsal valve, which is not figured, about 150 were counted.

Three casts of the interior of the dorsal valve of a shell which is probably referable to this species, from the local base of the Middle Devonian at Devils Point, Lake Winnipegosis (figs. 5 and 5 a) shew two linear grooves, which probably represent the impressions made by the brachial processes, diverging on each side of the umbo, also a minute and very short slit, which widens into a small subcircular or subrhomboidal perforation in the apex of the beak. Muscular impressions not clearly defined in any of the specimens collected.

Of the two testiferous specimens figured, the one showing the dorsal valve only (fig. 3) is thirteen millimetres long and sixteen broad, while the one drawn to shew the front margin (fig. 4) and relative convexity of the two valves, is nineteen mm. broad and eleven mm. and a half in depth or thickness, though it is too imperfect posteriorly to show the exact length.

Dawson Bay, Lake Winnipegosis, on the east side, at Whiteaves Point, and on two small islands in its immediate vicinity; on a small island about three miles north of Salt Point, and, on the west side, at the first small point north of the mouth of the Red Deer River, J. B. Tyrrell and D. B. Dowling, 1889: one to three specimens from each of these localities, most of the former being detached dorsal valves, the only example with both valves preserved being very immature.

The specimens for which the foregoing provisional name is suggested may prove to be only a small local variety of of the typical *O. Iowensis* of Hall, as originally described and figured in the Geology of Iowa, but not of the large northern form which has been referred to that species. They seem to differ from the typical *O. Iowensis* chiefly in their much smaller size and more quadrangular form; also, though this may be due to their being highly dolomitized, in the apparent absence of the "tubular openings" on the surface of the radiating striæ, and of "fine pores or punctæ over the entire surface," which are said to be characteristic of *O. Iowensis.*

(S.) ORTHOTHETES CHEMUNGENSIS, Conrad. (Sp.)

Strophomena Chemungensis, Conrad. 1842. Journ. Acad. Nat. Sc. Phil., vol. VIII, p. 257.
" *bifurcata*, Hall. 1842. Geol. Rep. Fourth Distr. N. York, p. 266, fig. 2.
" *arctostriata*, Hall. 1842. Ibid., p. 266, fig. 3.
" *pectinacea*, Hall. 1842. Ibid., p. 266, fig. 4.
Orthis perversa, Hall. 1857. Tenth Reg. Rep. N. York St. Cab. Nat. Hist., p. 137.
" *inequalis*, Hall. 1858. Geol. Surv. Iowa, vol. I, pt. 2, p. 490, pl. ii, figs. 6, a-c.
" *pravus*, Hall. 1858. Ib., p. 490.
Streptorhynchus Pandora, Billings. 1860. Canad. Journ., N. S., vol. V, p. 266, figs. 12 and 13; and Geol. Canada, 1863, p. 369, fig. 384.
Orthisina arctostriata, Hall. 1860. Thirteenth Reg. Rep. N. York St. Cab. Nat. Hist., p. 80.
" *alternata*, Hall. 1860. Ib., p. 81.
Streptorhynchus Chemungensis, Hall. 1867. Pal. St. N. York, vol. IV, p. 67, pls. iv, ix and x.
" " " (Var. A.) *Streptorhynchus Pandora*, Billings.
" " " (Var. B.) *S. arctostriata*, Hall.
" " " (Var. C.) *S. perversa*, Hall.
" " " (Var. D.) *S. pectinacea*, Hall.
Streptorhynchus Pandora, Nicholson. 1874. Pal. Prov. Ontario, p. 70.
Hemipronites Chemungensis, var. *arctostriata*, Meek. 1877. Geol. Expl. Fortieth Par., vol. IV, p. 117, pl. xiii, figs. 7, 16.
Streptorhynchus Chemungensis, Walcott. 1884. Pal. Eureka distr. Nevada, p. 117, pl. xiii, figs. 7, 16.
Orthothetes Chemungensis, Hall. 1892. Pal. St. N.Y., vol. VIII, pt. 1, p. 255.

Devils Point, Lake Winnipegosis, in the lowest beds of the Middle Devonian (six specimens); on the east side of Dawson Bay, Lake Winnipegosis, in the Stringocephalus zone, at Whiteaves' Point (two specimens), and on a small island about two miles north of this point (two specimens); J. B. Tyrrell, 1889.

According to Mr. C. D. Walcott (op. cit.) in the State of New York this species "ranges from the Upper Helderberg up into the Chemung group, and in the Eureka district" of Nevada "from the base to the summit of the Devonian limestone."

STROPHODONTA ARCUATA, Hall.

Strophodonta arcuata, Hall. 1858. Geol. Surv. Iowa, vol. I, pt 2, p. 492, pl. iii, figs. 1 a, b, c, and 2 a, b, e, f.

Lake Winnipegosis, on a small island at the extreme southern end of the lake, (one specimen), and on the east side of Dawson Bay, on a small island about two miles north of Whiteaves Point, (one specimen); J. B. Tyrrell, 1889. Red Deer River, half a mile above the Lower Salt Spring and two or three miles from Dawson Bay, (one perfect specimen), and at the Upper Salt Spring (abundant); J. B. Tyrrell, 1889.

(S.) STROPHODONTA INTERSTRIALIS, Phillips. (Sp.)

Plate 37, fig. 6.

Orthis interstrialis, Phillips. 1841. Pal. Foss. Dev., Cornw., and W. Somerset, p. 61, pl. xxv, fig. 103.

Leptæna interstrialis, Schnur. 1853. In Dunker & Von Meyer's Palæontographica, vol. III, p. 222, pl. xli, fig. 2.

Leptæna interstrialis, Davidson. 1864-65. Mon. Brit. Dev. Brach., p. 85, pl. xviii, figs. 15-18; also, Suppl. (1882-84) pl. iii, fig. 21.

East side of Dawson Bay, Lake Winnipegosis, on a small island about two miles north of Whiteaves Point, (three well preserved ventral valves, one of which is figured), and on another small island about the same distance to the south-west of that point (two similar specimens); J. B. Tyrrell, 1889.

These specimens are obviously much more like Davidson's figures of *Leptæna interstrialis* than they are to Hall's illustrations of the very closely allied *Strophodonta inæquistriata* of Conrad, in the fourth volume of the Palæontology of the State of New York. Prof. H. S. Williams, of Cornell University, Ithaca, to whom three of the best of these specimens were sent, for comparison, thus writes concerning them. The ventral valve figured "is a good representative of the *Leptæna interstrialis*, Phillips, as it appears at Lummaton, in South Devonshire. I have compared it with good specimens identified by Davidson. Our *Strophodonta inæquistriata*, *S. Patersoni* and *S. Cayuta* are allied forms, but your specimens are closer to the Lummaton forms than to either of our New York species." Davidson's figure of *L. interstrialis* on plate iii of the "Supplement to the British Devonian Brachiopoda," leave no doubt on the mind of the present writer that Phillips' species belongs to Hall's genus *Strophodonta.*

(S.) SPIRIFERA FIMBRIATA, Conrad.

Delthyris fimbriata, Conrad. 1842. Jour. Ac. Nat. Sc. Phil., vol. VIII, p. 263.

Spirifera fimbriata, Billings. 1861. Canad. Journ., N. Ser., vol. VI, p. 257, figs. 68-70.

" " Hall. 1858. Geol. Surv. Iowa, vol. I, pt. 2, p. 505, pl. iv, figs. 5 a-e.

" " Hall. 1867. Pal. St. N. York, vol. IV, p. 214, pl. xxxiii, figs. 1-21.

Spirifera fimbriata, Nicholson. 1874. Pal. Prov. Ont., p. 82.
Not *Spirifera fimbriata*, Morton. 1836. Am. Journ. Sc. and Arts, vol. XXXIX, p. 149.
Spirifera Conradana, S. A. Miller. 1883. Am. Pal. Foss., Second Ed., p. 298.
" " " " 1889. N. Am. Geol. and Palæont., p. 372.

Monroe Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: one perfect but not very well preserved dorsal valve. A single specimen of this species was also collected by Mr. J. B. Tyrrell or Mr. D. B. Dowling in 1889, at each of the following localities on or near Lake Winnipegosis: in the southern portion of the lake at a small island off Weston Point; in the Stringocephalus zone at several exposures in the eastern, south-western and western shore of Dawson Bay; on two small islands on the east side of the bay, and at the south end of Rowan Island, on its west side; also, in the Cuboides zone on the Red Deer River, half a mile below the Lower Salt Spring.

SPIRIFERA (MARTINIA) RICHARDSONII, Meek.

Plate 37, fig. 7.

Spirifera (Martinia) Richardsoni, Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 104, pl. xiv, fig. 2.

Lake Winnipegosis, at Point Brabant (two casts of the interior of ventral valves), and at Devils Point (two specimens); also, in Dawson Bay at a small point half a mile north of the mouth of Bell River (two specimens); at the head of a small bay about three miles south of Point Wilkins (several small specimens); and on the Red Deer River near the Lower Salt Spring; J. B. Tyrrell and D. B. Dowling, 1889. At each of these localities the specimens collected are small and rarely exceed half an inch in diameter. They are all a little longer than broad, nearly smooth, with an undeveloped or very feebly developed mesial fold and sinus.

In 1888 Mr. Dowling collected numerous specimens of a small *Spirifera*, which is probably referable to the present species, on the south-west side of Dawson Bay, at the second point north of the Red Deer River. These specimens (one of which is figured) are invariably hollow and imbedded in a vesicular dolomite in such a way as to show the character of the interior of the valves only, the spiral coils and hinge teeth being beautifully preserved. The hinge teeth of the ventral valve are slightly curved and diverge rapidly outward and forward. The shelly cones consist of only five loosely coiled, separate and rather distant, apparently smooth volutions, on each side.

CYRTINA HAMILTONENSIS, Hall.

Cyrtia Hamiltonensis, Hall. 1857. Tenth Rep. Reg. N. York St. Cab. Nat. Hist., p. 166.
“ “ Billings. 1861. Canad. Journ., N. Ser., vol. VI, p. 262, figs. 80-82.
“ “ Billings. 1863. Geol. Canada, p. 384, figs. 415 a-c.
Cyrtina Hamiltonensis, Hall. 1867. Pal. St. N. York, vol. IV, p. 268, pl. xxvii, figs. 1-4, and pl. xliv, figs. 26-33 and 38-52.
“ “ Meek. 1868. Trans. Chicago Ac. Sc., vol. I, p. 99, pl. xiv, figs. 5, 7 and 10.
“ “ Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 83.
“ “ Walcott. 1884. Pal. Eureka, distr. Nevada, p. 147.
“ “ Whiteaves. 1891. This volume, p. 226.

Onion Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: four specimens. A few characteristic examples of this species also were collected by Messrs. Tyrrell and Dowling in 1889 at each of the following localities: Lake Winnipegosis, at the north end of Snake Island, at a small island off Weston Point, on the north, south-east and south-west side of South Manitou Island and at Point Brabant; on the south-west side of Cameron Bay, and in Dawson Bay on a small island to the south-west of Whiteaves Point, at Point Wilkins, and at the head of a small bay south of Point Wilkins; at the C. P. R. crossing of Mossy River, Man.; on the Red Deer River at its mouth, and at the Lower and Upper Salt springs; at Rosebush Island in Swan Lake, and at the lowest crossing of the Swan River; also, *loose*, on the east side of Lake Winnipegosis, at a small island east of the south point of Birch Island.

In this district only one specimen of *C. Hamiltonensis* has been found in the Stringocephalus zone, but it appears to be everywhere abundant throughout the Upper Devonian.

ATHYRIS VITTATA, Hall.

Athyris vittata, Hall. 1860. Thirteenth Rep. Reg. N. York St. Cab. Nat. Hist., p. 89.
“ “ Hall. 1867. Pal. St. N. York, vol. IV, p. 289, pl. xlvi, figs. 1-4.

Warren Island (possibly the Rose Island of Mr. Tyrrell's map), Swan Lake, Manitoba, J. W. Spencer, 1874; six specimens.

Dawson Bay, Lake Winnipegosis, in the Upper Devonian rocks at Point Wilkins, and at an exposure about two miles south of Point Wilkins; also on Rose and Hog Islands in Swan Lake, J. B. Tyrrell and D. B. Dowling, 1889: apparently not uncommon at each of these localities. Most of the specimens collected are nearly perfect, but none of them show any of the characters of the interior of the valves. The mesial fold and sinus are rather feebly developed in each, and these specimens from Manitoba correspond much better with examples of *A. vittata* from the Hamilton shales of Muscatine and Scott counties, Iowa, kindly forwarded for comparison by Professor Calvin, than with the specimen from the Falls of the Ohio figured by Professor Hall.

(S.) ATRYPA RETICULARIS, L.

Plate 37, fig. 8.

For a full list of synonyms of this species, with references, see Davidson's "Monograph of the British Devonian Brachiopoda," page 53, the same author's "British Silurian Brachiopoda," p. 129, or Hall's "Palæontology of the State of New York, vol. IV, pt. 1, p. 316.

"Flat Rock Bay" and north end of Manitoba Island, Lake Manitoba, and Snake Island, Lake Winnipegosis; Prof. H. Y. Hind, 1858. Point Wilkins, on the west side of Dawson Bay, Lake Winnipegosis, and Warren Island, Swan Lake, Manitoba; J. W. Spencer, 1874. Found also, more or less abundantly, in nearly all the outcrops of Devonian limestone on the shores, islands and immediate vicinity of Lakes Manitoba and Winnipegosis examined by Messrs. Tyrrell, Dowling and the present writer in 1888 and 1889. Common throughout the whole series, but most abundant above the Stringocephalus zone.

In the Devonian rocks of the Mackenzie River district, as stated on page 230 of the present volume, the typical *A. reticularis* and its variety *aspera* are connected by numerous specimens which show intermediate gradations between the finely ribbed and coarsely plicated forms. On Lakes Manitoba and Winnipegosis, the two varieties, which almost always occur together, are remarkably constant to their respective characters. At each of these lakes the specimens of *A. reticularis* often have the broad "marginal fringe" or "foliated expansion" of the ventral valve preserved entire, but, as the matrix in which they occur is a hard dolomite, it is very difficult to reduce such specimens to a portable size without injuring them. The marginal fringe of the specimen figured (from Pentamerus Point, Lake Manitoba) is nearly an inch and three-quarters broad, and the shell has a maximum breadth of about four inches and a-half.

(S.) ATRYPA RETICULARIS, var. ASPERA, Schlotheim.

For a list of the synonyms of this shell, with references, see page 229 of the present volume.

Localities, collectors and dates practically the same as those for the preceding species. Common also throughout the whole series.

(S.) RHYNCHONELLA PUGNUS, Martin.

The synonymy of this species has already been given on pages 230 and 231.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 ; and Dawson Bay, Lake Winnipegosis, at the mouth of the Red Deer River, J. B. Tyrrell, 1889 : one small but characteristic specimen from each of these localities.

(S.) PENTAMERUS COMIS, Owen.

Atrypa comis, Owen. 1852. Rep. Geol. Surv. Wisc., Iowa and Minn., p. 583, pl. iii A, fig. 4.

Pentamerus occidentalis, Hall. 1858. Geol. Iowa, vol. I, pt. 2, p. 514, pl. vi, figs. 2a-c. Not *Pentamerus occidentalis*, Hall, 1852. Pal. St. N. York, vol. II, p. 341, pl. lxxix, figs. 1 a-s, and 2.

Pentamerus galeatiformis, Meek and Worthen. 1866. Rep. Geol. Surv. Illinois, vol. II, p. 325 (foot-note).

Gypidula occidentalis, Hall. 1867. Pal. St. N. York, vol. IV, p. 380, pl. lviii A, figs. 1-8.

Pentamerus comis, Meek and Worthen. 1868. Geol. Surv. Illinois, vol. III, p. 428, pl. xiii, figs. 6a-c.

" " Walcott. 1884. Pal. Eureka distr. Nevada, p. 159, pl. iii, figs. 4 and 7 ; pl. xiv, figs. 15, 15a, b ; and pl. xv, figs. 5, 5a, b.

" Western shore of Dawson Bay, from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874 : several single and for the most part ventral valves. Lake Manitoba, on the north-west side in the Stringocephalus zone, at Monroe and Pentamerus points, abundant, and on the east side, at Steep Rock Point, one specimen : J. B. Tyrrell and J. F. Whiteaves, 1888. South-west and west shores of Lake Winnipegosis, at Weston Point and a small island off Weston Point ; at Devils Point (in the beds beneath the Stringocephalus zone) ; and on the west side of Pelican Bay, J. B. Tyrrell, 1889 : a few specimens from each of these localities. Abundant also at many exposures of the Stringocephalus zone on the islands and shores of Dawson Bay, where it was collected by Messrs. Tyrrell and Dowling in 1889.

Next to *Atrypa reticularis* and its variety *aspera* this is the commonest species of brachiopoda in the Devonian rocks of this district, where it is usually found associated with *Stringocephalus*.

(S.) STRINGOCEPHALUS BURTINI, Defrance.

Strygocephalus Burtini, Defrance. 1827. Dict. des Sc. Nat., vol. LI, p. 102, and Atlas, pl. lxxxv, figs. 1 and 1a.

Terebratula porrecta, Sowerby. 1827. Min. Conch., pl. 576, fig. 1.

Stringocephalus Burtini, Davidson. 1865. Mon. Brit. Dev. Brach., p. 11, (which see for a complete list of synonyms of this species, with references) pl. i, figs. 18-22, and pl. ii, figs. 1-11.
" " Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 93, pl. iv, figs. 1-9; and (1891) this volume, p. 235, pl. xxix, figs. 10, 10a, 11 and 11a.

Western shore of Dawson Bay, Lake Winnipegosis, J. W. Spencer, 1874: a loose and imperfect cast of the interior of a very young shell. Lake Manitoba, at Monroe and Pentamerus Points, J. B. Tyrrell and J. F. Whiteaves, 1888: a few very large but imperfect and badly preserved specimens at each of these localities. South-west shore of Lake Winnipegosis, at Weston Point, J. B. Tyrrell, 1889: one imperfect cast. Collected abundantly and often in fine condition by Messrs. Tyrrell and Dowling, on six of the islands in Dawson Bay, and at eight more or less widely separated exposures around its shores.

The specimens from these localities have been described in some detail and illustrated in the eighth volume of "Transactions of the Royal Society of Canada."

(S.) TEREBRATULA SULLIVANTI, Hall.

Plate 37, figs. 9, 9a and 10.

Terebratula Sullivanti, Hall. 1867. Pal. St. N. York, volume IV, p. 387, pl. lx, figs. 5-10 and 68.

Lake Manitoba, at Monroe and Pentamerus Points, J. B. Tyrrell and J. F. Whiteaves, 1888: one good specimen at each of these localities. Dawson Bay, Lake Winnipegosis, on the south-east side, at Whiteaves Point and on three small islands in its immediate vicinity,—on a small island about three miles north of Salt Point, and on its south-eastern shore, about two miles west of Salt Point, J. B. Tyrrell and D. B. Dowling, 1889: collected rather sparingly at each of these localities, but most abundantly at Whiteaves Point, where eleven fine specimens were obtained, most of which are nearly perfect.

In some of these the anterior margin is simply truncated in the centre, and such specimens are essentially similar in external form to the example of *T. Sullivanti* from the Corniferous limestone of Cayuga (Ont.) represented by Prof. Hall on Plate lx, fig. 68, of the fourth volume of the "Palæontology of the State of New York." Others, again, are rather deeply emarginate in front, with a shallow mesial sinus in *both* valves, as in the original of figs. 9 and 9a on Plate xxxvii of this volume. The internal loop, which is seen only in one specimen, in which it is imperfect and obscured by a crystalline deposit, seems to have been originally both short and narrow.

PELECYPODA.

(S.) PTERINEA LOBATA. (N. Sp.)

Plate 38, figs. 1–4.

Shell inequivalve, compressed at the sides, though the main body of the left valve, apart from the two wings, is moderately convex : marginal outline subovate, the length being about one-fourth greater than the height : outer margin of the valves in adult specimens shallowly but distinctly lobate. Anterior side short, its wing comparatively large, pointed and projecting, and the lower part of its margin, beneath the wing, rounding abruptly into the base, at least in the immature specimen represented by fig. 3, but apparently somewhat produced above and sinuate below in adults, as in the original of fig. 1, which shows indications also of what seems to have been a byssal sinus, below the anterior ear of the right valve. Posterior side longer than the anterior : the outline of the former not satisfactorily shewn in any of the full or even half-grown specimens collected, though in the largest individual (fig. 1) it appears to be longest and obtusely pointed a little below the middle, beneath which it narrows rapidly into the base below, in two shallowly concave curves, with a slight prominence between them. Posterior wing of the adult shell elongated, its exact contour unknown, but, in the left valve of a very young shell which may possibly be referable to this species (fig. 4), the posterior alation is concave at its outer margin, and the posterior end rounded and somewhat produced below. Beaks rather small, scarcely raised above the highest level of the hinge line and placed a little in advance of the midlength.

Central portion of each valve marked by from five to seven, usually six, rounded and slightly nodulous radiating plications, which broaden rapidly outward and project a little beyond the front margin as rounded lobes, with a shallowly concave sinus between each pair. The spaces between the plications and the posterior wing also, are marked with narrow radiating ridges, and the concentric markings consist of numerous, more or less close-set, raised lines, which seem to be most prominent on the posterior wing of the left valve. Hinge dentition and muscular impressions unknown.

Dawson Bay, Lake Winnipegosis,—on the south-east side, at Whiteaves Point, and on a small island between that point and Salt Point ; on the south-west shore, at a small point about two miles east of the mouth of Steep Rock River, and at an exposure about two miles west of Salt Point, J. B. Tyrrell, 1889 : one or two imperfect and not very well preserved specimens from each of these localities.

Although in rather poor condition, these specimens are obviously very dissimilar to any of the known species of *Aviculidæ* from the Devonian rocks of North America or Europe. Their lobate outer margin, in the adult state, gives them a certain general resemblance to *Tridacna*, but they seem to indicate a new generic type, which cannot be satisfactorily defined until the characters of the interior of the valves are ascertained.

(S.) ACTINOPTERIA BOYDII, Conrad.

For the synonymy of this species, with references, see page 239.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: four specimens. Dawson Bay, Lake Winnipegosis, on the south-east side, on a small island to the north of Whiteaves Point, D. B. Dowling, 1888: one specimen. South-west side of Lake Winnipegosis, on a small island off Weston Point, one specimen: J. B. Tyrrell, 1889. Dawson Bay,—on the south-east side, at Whiteaves Point (one specimen) and on a small island north of that point (abundant); on a small island half way between Whiteaves and Salt Points (two specimens); on the west shore, at the first small point north of the mouth of the Red Deer River (abundant) and on the second small point north of the same river (nine specimens): J. B. Tyrrell and D. B. Dowling, 1889.

Two or three additional species of Aviculidæ are indicated in the collections made by Messrs. Tyrrell and Dowling, but the specimens in each case are mere casts of the interior of the shell, which are too imperfect and badly preserved to admit of their being identified or described.

(S.) GOSSELETIA. (Sp.)

South-west shore of Dawson Bay, Lake Winnipegosis, about two miles west of Salt Point, J. B. Tyrrell, 1888: a single cast of the interior of the closed valves of a species of this genus, which although evidently undescribed, is too imperfect to be properly characterized.

(S.) MYTILARCA INFLATA. (N. Sp.)

Plate 38, figs. 5, 6 and 6a.

Shall small to medium sized, mytiloid, straight, strongly inflated: length,* from the beaks to the opposite extremity, about one third greater than the maximum height or dorso-ventral diameter: thickness through the closed valves a little greater than their height. Valves equal, tumid in the ventral region, most prominent and subangular on each of the umbonal slopes, thence inflected rather abruptly and more or less convexly inward on the ventral side and obliquely compressed or narrowing convexly and more gradually on the dorsal. Ventral border straight for the greater part of its length: postero-dorsal margin moderately elevated, most prominent and faintly subangular a little behind the midlength: hinge line short, oblique: posterior or anal margin broadly and obliquely rounded, though its junction with the end the farthest removed from the beaks is either narrowly rounded or somewhat pointed : umbones prominent, much narrower in their dorso-ventral than in their lateral diameter: beaks terminal, curved strongly inward and slightly forward.

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* Dr. Paul Fischer (Manuel de Conchyliologie, p. 963) calls this the height and the dorso-ventral diameter the length.

Surface markings and characters of the interior of the valves unknown. The casts of the interior of the valves, however, are marked with a few, irregularly disposed but for the most distant lines of growth or concentric wrinkles.

In the largest specimen collected (the original of fig. 5) the maximum length is thirty-eight millimetres, the greatest height twenty-one mm., and the thickness through the closed valves is estimated at twenty mm., but in other specimens, such as the one represented by figs. 6 and 6 a, the greatest thickness considerably exceeds the maximum height.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: ten specimens, most of which are very small. Dawson Bay, Lake Winnipegosis,—on two small islands off Whiteaves Point (two specimens from one island and one from the other),—on the south-west shore about two miles west of Salt Point (two specimens, one unusually large, the original of fig. 5), and on the west shore at the mouth of the Red Deer River (three specimens): J. B. Tyrrell, 1889.

In this species the greatest height of the valves is invariably a little behind the midlength, the dorsal margin being longer than the anal. In this and in some other respects the largest specimen collected (fig. 5) differs materially from the *M. gibbosa* of Hall, to which it otherwise bears a certain general resemblance. Other and smaller specimens of *M inflata* approach nearer to some of the shorter varieties of *M. carinata*, Hall, in lateral outline, but the former are never as distinctly angulated on the umbonal slope as the latter are said to be. According to Dr. Frech, **Mytilarca*, Hall, is exactly synonymous with *Myalina*, and, if this be the case, the present species will have to be called *Myalina inflata*.

(S.) MYALINA TRIGONALIS. (N. Sp.)

Plate 38, figs. 7, 7a and 7b.

Shell of medium size, subcuneiform in lateral outline, truncated somewhat obliquely at the posterior end and distinctly triangular in transverse section: length nearly twice as great as the maximum height, and about one-third greater than the maximum breadth. Valves broader than high, most prominent and strongly angulated on each of the ventral umbonal slopes, and flattened in the ventral region, the outline of which, as seen in full front view (as in fig. 7 a) is ovate cordate: sides (see fig. 7) obliquely compressed, faintly and longitudinally depressed next each ventral umbonal slope, then slightly elevated in the same direction, in such a way as to form a low, rounded and obscure dorsal umbonal ridge, which becomes obsolete at a short distance from the posterior end, in each valve, and ultimately narrowing abruptly into the dorsal margin. Hinge line short, oblique: dorsal margin long, nearly straight, but slightly bent a little in advance of the midlength, at first divergent from the anterior margin at an angle of about 55° but afterwards nearly parallel with it, the greatest height of the valves being at the junction of the dorsal margin with the truncated posterior end, which is obtusely pointed below. Umbones prominent: beaks terminal, incurved and slightly recurved.

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* Zeitschr. der Deutsch geol. Gesellsch., 1888, vol. XL, p. 363.

Surface marked only with concentric lines of growth, which are rather irregularly disposed. Characters of the interior of the valves unknown.

Dimensions of the only specimen collected: maximum length, thirty-one millimetres; greatest height, sixteen mm.; maximum breadth, twenty-one mm. and a half.

West side of Dawson Bay, at the first small point north of the mouth of the Red Deer River, D. B. Dowling, 1889: one nearly perfect specimen.

This interesting shell seems to be congeneric with the so-called "*Cardium dimidiatum*" of Goldfuss,* which the late Ferdinand Roemer doubtfully referred to *Mytilus*† and Tschernyschew‡ to *Mytilarca*. The two species may, however, be readily separated, even at a glance, by the great difference in their lateral contour.

(S.) MODIOMORPHA ATTENUATA.

Modiomorpha attenuata, Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 96, pl. v, figs. 1 and 1a. (Separate copies.)

South-east side of Dawson Bay, Lake Winnipegosis, at Whiteaves Point, J. B. Tyrrell, 1889: "one nearly perfect cast and three very imperfect casts of the interior of the shell." The specimen upon which the species was mainly based would, if perfect, have slightly exceeded seven inches in length.

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* Petref. Germ., vol. II, p, 284, pl. clx, fig. 14.

† Lethoea Geognost., vol. I, Atlas, pl. xxix, figs. 3a, b, and ex. pl.

‡ Die Fauna des Mittleren und Ober. Devon am West Abh. des Urals., 1887, Mem. du Com. Geol., vol. III, p. 47, pl. vii, fig. 11.

(S.) MODIOMORPHA COMPRESSA. (N. Sp.)

Plate 38, figs. 8 and 9.

Shell subelliptical, moderately elongated, nearly twice as long as high, and very inequilateral: valves strongly compressed laterally, very gently convex, and most prominent on the oblique posterior umbonal slope of each valve, and broadly but shallowly depressed in front of these slopes. Anterior side short and narrowly rounded: posterior side much longer than the anterior, its outer margin obliquely truncated above and narrowly rounded below: dorsal margin nearly straight or very gently convex, ascending slightly behind and ultimately forming an obtusely subangular junction with the posterior end: ventral margin nearly straight and faintly concave in the centre in some specimens, but somewhat convex in others: umbones broad, compressed and depressed: beaks curved inward and forward, placed very near to the anterior end, but not quite terminal.

Surface markings not satisfactorily shown, all the specimens collected being mere casts of the interior of the valves. A small portion of the test, which happens to be still adherent to the posterior end of one of these casts (fig. 8) is, however, marked by two or three concentric raised lines. Anterior muscular impression nearly circular, comparatively large, and situated close to the anterior margin. Pallial line distinctly impressed, entire and parallel to the ventral margin. Posterior muscular impression and characters of the hinge dentition unknown.

The specimens are all too imperfect to admit of an accurate statement of their dimensions, but both of the figures are of natural size.

Shores of Dawson Bay, Lake Winnipegosis, at Whiteaves Point (three specimens), and about two miles east of Salt Point (two specimens); J. B. Tyrrell, 1889.

This shell has much the same lateral outline as the *M. altiforme* of Walcott*, from the Lower Devonian of Nevada, but the former is strongly compressed at the sides and the latter as strongly convex.

MODIOMORPHA TUMIDA. (N. Sp.)

Plate 38, figs. 10 and 10 a.)

Shell of medium size, ovately subelliptical, rather less than twice as long as high, and highest a little behind the midlength: valves tumid and strongly inflated in the umbonal region, but obliquely compressed in the antero-ventral: anterior side short, narrow and abruptly rounded or somewhat pointed: posterior side broader and much longer than the anterior, its extremity rather narrowly rounded, but rather more broadly curved below than above: cardinal margin nearly straight immediately behind the beaks, thence rising into a short and not very prominent, obtusely angular alation about half way between the beaks and the posterior end (at least, in the largest specimen collected, the original of fig. 10), and ultimately sloping very gradually downward: ventral margin gently convex posteriorly, but straight anteriorly: umbones rather broad: beaks curved inward and forward, placed near the anterior end. Surface concentrically striated. Hinge dentition and muscular impressions unknown.

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* Palæont. Eureka distr. Nevada, 1884, p. 169, pl. v., fig. 9.

Maximum length of the specimen figured, fifty-five millimetres; greatest height of the same, thirty-two mm.

Lake Winnipegosis, on the south-west side, at a small island off Weston Point (five specimens), and on the southern shore of Dawson Bay, at the second small point east of the mouth of Bell River (two specimens); J. B. Tyrrell, 1889.

(S.) MODIOMORPHA PARVULA. (N. Sp.)

Plate 38, fig. 11.

Shell very small, averaging from a little over half an inch to three-quarters of an inch in length, about one-third longer than high, and highest at the posterior termination of the cardinal margin. Valves moderately convex, most prominent and subangular on each of the posterior umbonal slopes, but obliquely compressed on the antero-ventral and posterodorsal sides of these slopes. In some specimens there is a shallowly concave depression immediately in front of the umbonal slope. Anterior side narrow and very short, forming a small abruptly rounded lobe below and in front of the beak: posterior side longer and broader than the anterior, its outer margin curved convexly and more or less obliquely downward above, and ultimately forming a somewhat pointed junction with the base below: cardinal margin rather long, straight and very gently ascending behind the beaks: ventral margin nearly straight, but slightly concave in the centre: beaks minute, depressed, curved inward and forward, anterior, very nearly but not quite terminal.

Surface nearly smooth, marked only with fine concentric striæ, or minute lines of growth. Anterior muscular impression large, placed close to the anterior margin, and below the beaks. Posterior muscular impression, pallial line and hinge dentition unknown.

Maximum length of the specimen figured, fourteen millimetres; greatest height of the same, nine mm.

Lake Winnipegosis, on the north-west side, at Devils Point (a cast of the interior of both valves); on the south-west side of Dawson Bay, two miles west of Salt Point (one specimen with the test preserved), and on the west side of Dawson Bay, at the first small point north of the mouth of the Red Deer River (nine casts of the interior of the partly open or displaced valves); J. B. Tyrrell and D. B. Dowling, 1889.

Some of these specimens are more obliquely truncated posteriorly and more pointed at the base, than is the case with the original of fig. 12. Such individuals bear a rather close resemblance, both in lateral outline and in size, to some forms of the *Modiella pygmæa* of Conrad, as figured by Hall*, but in that species the valves are much more convex proportionately, and not at all angulated on the posterior umbonal slopes.

(S.) SPATHELLA SUBELLIPTICA. (N. Sp.)

Plate 38, fig. 12.

Shell rather small, narrowly subelliptical, rather less than twice as long as high, but a little higher behind the midlength than in front of it, and very inequilateral. Valves usually tumid and strongly convex in the umbonal region, but narrowing rather rapidly into the ventral and posterior margins: anterior side narrow, very short and rounding abruptly into the ventral margin: posterior side broader and much longer than the anterior, its extremity narrowly rounded: cardinal line occupying about one half of the entire length, nearly straight, but very slightly ascending posteriorly: ventral margin nearly straight, slightly convex and almost parallel with the dorsal margin: beaks small, depressed, incurved, anterior and very nearly but not quite terminal.

Surface marked with concentric striæ and raised lines of growth, which latter are most prominent posteriorly. Hinge dentition and muscular impressions unknown.

Maximum length of the specimen figured, twenty-five millimetres and a half; greatest height of the same, fourteen mm.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: a nearly perfect specimen, which, however, is much less convex in the umbonal region than usual. Western shore of Dawson Bay, Lake Winnipegosis, on the second small point north of the mouth of the Red Deer River, D. B. Dowling, 1889: eight specimens, two of which are nearly perfect, and upon which the foregoing description is based. A very imperfect specimen from the north side of South Manitou Island, in Lake Winnipegosis, and an equally imperfect one from an exposure a mile above the Lower Salt Spring on the Red Deer River, both collected by Mr. Tyrrell, in 1889, are probably referable to the present species.

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* Pal. St. N. York, vol. V, pt. 1, Lamellibr., 2, p. 514, pl. lxxvi, figs. 9-20.

A few badly preserved specimens of a shell, which may be a variety of *S. subelliptica*, were collected by Mr. Tyrrell, in 1889, at a small island off Weston Point, Lake Winnipegosis. They differ from the typical form chiefly in being almost exactly twice as long as high, and in the circumstance that their posterior umbonal slopes are obscurely or very faintly subangular.

S. subelliptica is obviously congeneric with *Spathella ventricosa*, the *Orthonota ventricosa* of White and Whitfield, as figured by Hall[*], and differs from that species only in being much shorter in proportion to its height. It may prove to be identical with the *Cypricardites uralicus* of Tschernyschew.[†]

(S.) GONIOPHORA PERANGULATA, Hall, var.

Plate 39, figs. 1 and 1a.

Sanguinolites perangulatus, Hall. Prelim. Notice Lam. Shells, p. 35.

Goniophora perangulata, Hall. 1883. Pal. St. N. Y., vol. V, pt. 1, Plates and Explanations, p. 12, pl. xxxiv, figs. 1-7.

" " Walcott. 1884. Pal. Eureka distr. Nevada, p. 171, pl. xv, fig. 10.

" " Hall. 1885. Pal. St. N.York, vol. V, pt. 1, Lamellibr., 2, p. 293, pl. xxxiv, figs. 1--6, and pl. xlii, figs. 1 and 2.

Dawson Bay, Lake Winnipegosis, two miles west of Salt Point, and on one of the small islands east of Salt Point, J. B. Tyrrell, 1889 : a somewhat imperfect cast of the interior of the partly open valves, from each of these localities.

These two specimens, which are rather doubtfully referred to *G. perangulata*, appear to be in some respects intermediate in their characters between that species and *G. acuta*, Hall, their hinge line, in particular, being apparently longer proportionately than that of *G. perangulata*. In the specimen figured, the posterior half of the dorsal margin is imperfect, but when entire, the dorsal margin was probably regularly arched and moderately convex for the whole of its length, and not flattened somewhat obliquely behind, as represented in fig. 1.

(S.) MACRODON PYGMÆUS. (N. Sp.)

Plate 39, figs. 2 and 3.

Shell decidedly small, usually less than half an inch in length, narrowly elongated, nearly or quite twice as long as high, somewhat trapezoidal and very inequilateral. Valves strongly convex in the umbonal region, both posteriorly and anteriorly, but slightly depressed in the centre below: posterior area obliquely and abruptly compressed.

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[*] Pal. St. N. York, vol. V. pt. 1, Lamellibr. 2, p. 408, pl. lxvi, figs. 41 and 42.

[†] Die Fauna des Mittl. und Oberer Devon am West—Abh. des Urals. 1887. Mémoires du Comité Géolog., vol. III, p. 50, pl. vii, figs. 4 and 5.

Anterior side very short, angular above and rounding both rapidly and abruptly inward into the ventral margin below: posterior side much longer and a little broader than the anterior, its extremity obliquely truncated or subtruncated above and narrowly rounded below : cardinal border nearly straight behind the beaks, in some specimens (as in fig. 3) nearly parallel with the ventral margin, in others (as in fig. 2) ascending and subalate posteriorly : ventral margin almost straight but faintly concave in the centre and rounding upward very abruptly at each end : umbones prominent and comparatively broad : beaks depressed, curved inward and slightly forward.

Surface markings consisting apparently of concentric and lamellose lines of growth. Muscular impressions unknown: hinge dentition for the most part unknown, though in the cast of the interior of the left valve represented by fig. 2, there are impressions of two of the thin, laminar and elongated posterior teeth parallel to the hinge line.

Maximum length of one of the most perfect specimens collected (the right valve represented by fig. 3), ten millimetres, greatest height of the same, inclusive of the beaks, five mm. and a quarter.

A large mould of the exterior of the right valve, however, which is not figured but which gives the only information available about the surface markings of the test, is a little over fourteen millimetres in length.

Lake Winnipegosis, on the north-western shore, at Devils Point, in the Upper Devonian (four single valves); and in the Stringocephalus zone at Dawson Bay, on the south-east side, on a small island to the south-west of Whiteaves Point (one right valve), and on the south-west side, at the mouth of Steep Rock River (the left valve represented by fig. 2): J. B. Tyrrell, 1889.

All the specimens from these localities, except the solitary mould of the exterior of a right valve already referred to, are perfect and well preserved casts of the interior of the right or left valve. The species is perhaps most nearly related to, but probably distinct from, the *M. parvus* of White and Whitfield,* from the yellow sandstone at Burlington, Iowa, which Dr. White regards as the lowest member of the Lower Carboniferous in the Mississippi valley.

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* Proc. Boston Soc. Nat. Hist., 1882, vol. VIII, p. 299.

NUCULA LIRATA, Conrad.

Nucula lirata, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VII, p. 250, pl. xv, fig. 7.
" " Hall. 1870. Prelim. Not. Lamellibr. Shells, 2, p. 3.
" " " 1883. Pal. St. N. York, vol. V, pt. 1, Plates and Explanations, pl. xlv, figs. 17-27.
" " " 1885. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 2, p. 316, pl. xlv, figs. 5, 11, 15, 17-22, 24, 25, and pl. xciii.

North side of Manitoba Island, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: two or three badly preserved single valves.

(S.) NUCULA ? MANITOBENSIS. (N. Sp.)

Plate 41, fig. 1.

Shell rather small, ovately trapezoidal, about one-third longer than high and very inequilateral. Valves gibbous, tumid in the umbonal region and above, but obliquely compressed and somewhat depressed in the centre below: anterior side (assuming it to be a *Nucula*)* much longer than the posterior, its outer margin obliquely subtruncate above and forming an obtusely pointed junction with the base below: posterior side extremely short, its margin concave immediately under the overhanging beaks and narrowly rounded below; cardinal margin gently convex, curving rather rapidly downward posteriorly: ventral margin nearly straight for the greater part of its length, but curving upward abruptly at both ends: umbones broad, depressed, anterior, terminal: beaks curved inward, forward and a little downward.

Surface apparently almost smooth and marked only with faint concentric striæ of growth. Hinge dentition and muscular impressions unknown.

Length of the largest specimen collected, nine millimetres; greatest height of the same, six mm. and a half.

Dawson Bay, Lake Winnipegosis, on a small island north of Whiteaves Point, and on its south-western shore, at an exposure about two miles west of Salt Point, J. B. Tyrrell, 1889: a single right valve from each of these localities.

As the characters of the interior of the valves of this species are entirely unknown, it is quite uncertain to what genus it should be referred. It is here provisionally regarded as a *Nucula* on account of its general resemblance, in external form, to some varieties of the *N. varicosa* of Hall, as figured on Plates xlvi and xciii, of vol. V, Pt. 1, (Lamellibr., 2) of the

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* Dr. S. P. Woodward (Manual of the Mollusca, p. 269) says that in *Nucula* the umbones are "turned to the short, posterior side."

Palæontology of the State of New York. The present species, however, may readily be distinguished from *N. varicosa*, by its much smaller size, more trapezoidal contour and by the apparent absence of "strong varices of growth."

NUCULITES, Sp.

Plate 39, fig. 4.

An imperfect cast of the interior of a single valve of a small and apparently undescribed species of *Nuculites* was collected by Mr. J. B. Tyrrell and the present writer in 1888, on the north shore of Manitoba Island. The specimen, which is not more than five millimetres in length, is too imperfect for specific description, but it shows clearly the impression of the "vertical clavicular ridge just anterior to the beaks," which is so characteristic of the genus. The general contour of this specimen is not very dissimilar to that of the *N. oblongata* of Hall (from the Hamilton group of the State of New York), but that species attains to a length of from twenty-four to thirty-five mm., and is much more obtusely pointed at the longer and so-called posterior end.

(S.) KEFERSTEINIA SUBOVATA.

Megalodon subovatus, Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p.97, pl. v., figs. 2, 2a, 3 and 3a. (Separate copies.)

Cameron Bay, Lake Winnipegosis, on the south-west side, three miles south of Graves Point (one small cast): Dawson Bay, in the same lake, on Beardy Island (one small cast), on the south-west shore, two miles west of Salt Point (six specimens), four miles west of that point (several specimens, some with the test preserved), and a few miles farther west, at the first small point east of the mouth of Steep Rock River (four large casts); also on the west shore, at the mouth of the Red Deer River (two specimens): J. B. Tyrrell, 1889.

A left valve of a small bivalve shell from Pentamerus Point, Lake Manitoba, and a cast of the interior of both valves of an equally small specimen from Onion Point, on the same lake, both collected by Mr. Tyrrell and the writer in 1888, are probably immature examples of this species.

K. subovata was originally "referred to the genus *Megalodon* on account of its strong resemblance in internal structure to the *M. truncatus* and *M. rhomboidalis* of Goldfuss, from the Devonian rocks of the Eifel." It was, however, stated (op. cit. pp. 97 and 98) that, in each of these shells the "hinge seems to be constructed on a somewhat different plan to that of the type of the genus, the *M. cucullatus* of Sowerby," and that a new genus or subgenus would probably have to be constituted for the reception of the little group of species, including the present one, of which *M. truncatus* is the type. For this new genus the name *Kefersteinia* has been recently proposed by Professor M. Neumayr, in a paper published since his death by the Royal Academy of Sciences of Vienna.*

On the other hand, it is only proper to add that, so far back as 1851, Grünewaldt† claimed that the *Megalodus truncatus* of Goldfuss is a *Myophoria*. Dr. Frech, also, in a paper upon *Mecynodon* and *Myophoria*,‡ places Goldfuss's species in the group of *Myophoria lævigata* and maintains that it belongs to the older Trigoniadæ. Dr. Frech thinks that all the species figured by Hall under the name *Schizodus*, on Plate lxxv of vol. V, pt. 1 (Lamellibr., 2) of the Palæontology of the State of New York, belong to the genus *Myophoria* and that the name *Schizodus* should be restricted to the Permian species. According to this view, the fossil from the Hay River, which is referred to *Schizodus Chemungensis* on page 241 of the present volume and figured on Plate xxx, figs. 5 and 5a, would also be a *Myophoria*, but it may be a *Kefersteinia*, and not very improbably even an immature example of *K. subovata*.

(S.) MECYNODON. (Sp.)

(Cfr. *M. Eifeliensis*, Frech.)

Mecynodon eifeliensis, Frech. 1889. Zeitschr. der Deutsch. geolog. Gesellsch., vol. XLI, p. 130, pl. xi, figs. 7 and 7a.

Dawson Bay, Lake Winnipegosis, at the mouth of the Red Deer River, J. B. Tyrrell, 1889 : a cast of the interior of the left valve of a species of *Mecynodon*, which, although too imperfect to be determined specifically, is believed by Dr. Frech, who has seen the specimen, to be at least closely related to his *M. eifeliensis*.

ANODONTOPSIS AFFINIS. (N. Sp.)

Plate 40, figure 6.

Shell small, rather narrowly subelliptical, about one-third longer than high and very inequilateral. Valves compressed convex : posterior area gently inflected and indistinctly defined, as the faint angulation on the posterior side of the umbones becomes obsolete and disappears about half way between the beaks and the postero-basal margin. Anterior side short, its margin regularly rounded: posterior side much longer than the anterior, its extremity obliquely subtruncated above and narrowly rounded below: ventral margin gently convex anteriorly and nearly straight but slightly ascending posteriorly: cardinal margin curving very abruptly downward in front of the beaks, nearly straight, with a slight downward declination, behind them, and ultimately curving obliquely and rapidly downward and outward posteriorly: umbones depressed and compressed: beaks small, incurved, with a forward inclination, placed near the anterior end but not quite terminal.

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* Beitr. zu Einer Morphol. Eintheil. der Bivalven. Denkschr. der Math.-Naturwiss. Schaftl. cl. der Kaiserl. Ak. der Wissenschaft. Wien, 1891. Vol. LVIII, p. 88.

† Zeitschr. der Deutsch. geol. Gesellsch., 1851, vol. III, p. 252.

‡ Ib., 1889, vol. XLI, p.p. 127-138.

Surface markings and muscular impressions unknown. In the specimen figured, which is the cast of the interior of a left valve, the existence of a long and thin lateral tooth in that valve seems to be indicated by a narrow longitudinal grove which runs parallel with and close to the cardinal margin for the whole of its length behind the beaks.

Length of the left valve figured, sixteen millimetres: greatest height of the same, ten mm.

Devils Point, Lake Winnipegosis, J. B. Tyrrell, 1888: a single but very perfect cast of the interior of both valves, which are widely open and partially detached.

This little shell seems to be very closely related to the *Anodontopsis concinna* of the Guelph limestone of Ontario*, but the valves of the former are much narrower in proportion to their height, more pointed posteriorly, and their posterior umbonal slopes are much less distinctly angulated.

(S.) PARACYCLAS ANTIQUA, Goldfuss. (Sp.)

Plate 39, fig. 6.

Lucina antiqua, Goldfuss. 1834–40. Petref. Germ., vol. II, p. 226, pl. cxlvi, figs. 7a, b.

Devils Point, Lake Winnipegosis (three specimens); also in the Stringocephalus zone at Dawson Bay, on the same lake, on the south-west side, two miles west of Salt Point (one specimen), on the west side, at the mouth of Steep Rock River (three specimens), and at the first small point north of the Red Deer River (one specimen): J. B. Tyrrell and D. B. Dowling, 1889.

Seven of these specimens are well defined moulds of the exterior of the closed valves and one is a cast of the interior. The figure is taken from a wax impression of one of these moulds, in which the valves are thirty millimetres in length and nearly thirty-two in height.

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* Geol. and Nat. Hist. Surv. Canada, Pal. Foss., vol. III, (pt. 1.) p. 12, pl. ii, fig. 4, and pl. vii, figs. 4 and 4a.

The writer has failed to find a single character by which these specimens from Lake Winnipegosis can be satisfactorily distinguished from the *Lucina antiqua*, of the Devonian rocks of the Eifel, as described and figured by Goldfuss. The phrase "umbonibus postmedianis" of the original description of that species, it is true, is not applicable to any of the specimens collected by Messrs. Tyrrell and Dowling, but in Goldfuss's figures of *L. antiqua*, the umbones and beaks are represented as placed a little in advance of the midlength.

Judging by the descriptions and figures of both, it is difficult to see upon what grounds the *Paracyclas Ohioensis* of Meek is separated from *P. antiqua*. Each of the eight specimens from Lake Winnipegosis is characterized by the "strongly oblique sulcus, extending from the back part of the beaks to the upper part of the posterior margin," on the "posterior dorsal slope of each valve," which Mr. Meek relies upon as the distinguishing feature of *P. Ohioensis*, but which is equally characteristic of *P. antiqua*.

PARACYCLAS ELLIPTICA, Hall.

Paracyclas elliptica, Hall. 1843. Geol. Surv. N. York, Rep. Fourth Distr., p. 171, pl. lxvii, fig. 2.

Lucina (Paracyclas) elliptica, var. *occidentalis*, Hall and Whitfield. 1882. Twenty-fourth Reg. Rep. N. York St. Mus. Nat. Hist., p. 189.

Paracyclas elliptica, Hall. 1883. Pal. St. N. York, vol. V, pt. 1, Plates and Explanations, pl. lxxii, figs. 23-30.

" " 1885. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 2, p. 440, pl. lxxii, figs. 23-33, and pl. xcv, fig. 18.

A few specimens of the large and typical form of this species were collected by Messrs. Tyrrell, Dowling and the present writer, in 1888 and 1889, at Onion Point, Lake Manitoba, and at many of the exposures on the shores and islands of Lake Winnipegosis.

PARACYCLAS ELLIPTICA, var. OCCIDENTALIS, Billings.

Plate 39, figs. 7-10.

Lucina occidentalis, Billings. 1859. In Hind's Rep. Assinib. and Saskatch. Expl. Exped., p. 187, wood-cut, figs. 1b, c.

Lucina elliptica, Billings, as of Conrad. 1859. Ib., p. 187, wood-cut, fig. 1d.

Paracyclas Billingsana, S. A. Miller. 1883. Am. Pal. Foss., Second Ed., p. 311.

In 1858, Professor H. Youle Hind collected two lamellibranchiate shells, which are still in the Museum of the Survey, from the Devonian rocks at Snake Island in Lake Winnipegosis. Both of these were figured by Mr. E. Billings (op. cit. p. 187), who regarded one as identical with *Lucina elliptica*, Conrad. (sic), and described the other as a new species, under the name *Lucina occidentalis.* To the present writer these two specimens appear to be merely somewhat distorted individuals of the same species, the one referred to *L. elliptica* being abnormally compressed in the direction of its height, and that described as *L. occidentalis* in the direction of its length. Similar specimens collected by Messrs. Tyrrell and the present writer, at Manitoba Island and Onion Point, Lake Manitoba, in 1888, and by Messrs. Tyrrell and Dowling abundantly at most of the exposures on the shores or islands of Lake Winnipegosis, in 1889, are almost exactly intermediate in their characters between *P. elliptica*, Hall, and *P. lirata*, Conrad. They perfectly resemble the latter species both in size and shape, but their "concentric undulations of growth" are rounded and flattened, not prominent and subangular as in *P. lirata.* It is highly probable, however, that *P. elliptica* is only a variety of *P. lirata.*

Both the typical form and the var. *occidentalis* of Billings (not of Hall and Whitfield) are most abundant in the argillaceous limestones above the Stringocephalus zone, and at the local base of the Upper Devonian.

In his latest description of *P. elliptica*, Prof. Hall points out that it is "subject to great variation in form from compression," a statement which is equally applicable to the specimens from Lake Winnipegosis, four of which are represented on plate xxxix. Fig. 8 on that plate represents the type of *L. occidentalis*, Billings, the wood-cut of that shell in Prof. Hind's report being neither as accurate nor as characteristic as could be wished. Fig. 7 represents a specimen from Dawson Bay, which is quite free from distortion or compression. In the original of fig. 10, which is from the Red Deer River, at the Upper Salt Spring, the compression in the direction of the height has reached its maximum, while in the original of fig. 9, which is also from the Red Deer River, the compression has obviously been oblique.

(S.) PARACYCLAS. (Sp. Undt.)

Plate 39, figs. 5 and 5a.

Three specimens of a large and apparently undescribed species of *Paracyclas* were collected by Mr. Dowling, in 1889, on the western shore of Dawson Bay, at the first small point north of the mouth of the Red Deer River. Two of these are casts of the interior of the shell, and one is a natural mould of the exterior of the closed valves, but all three are too imperfect and too badly preserved to admit of identification or description. The figures on plate xxxix are taken from a wax impression of the mould of the exterior, but the ventral margin is slightly restored from the lines of growth. The shell seems to have been larger and more globose than *P. elliptica,* but the wax impression from which the figures were made does not give a clear idea of the shape of the valves, or of their surface markings.

(S.) CONOCARDIUM OHIOENSE, Meek.

Conocardium Ohioense, Meek. 1871. Proc. Ac. Nat. Sc. Philad., p. 9.
" " Meek. 1873. Geol. Surv. Ohio, vol. I, pt. 2, p. 203, pl. xviii, fig. 9, and wood-cut a on p. 204.
" " Hall. 1883. Pal. St. N. York, vol. V, pt. 1, Plates and Expl., pl. lxviii, figs. 2 and 3.
" " Hall. 1885. Pal. St. N. York, vol. V, pt. 1, Lamellibr., 2, p. 411, pl. lxviii, figs. 2 and 3.

" Western shore of Dawson Bay," Lake Winnipegosis, "from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874 : four specimens.

Monroe Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 : four specimens. Dawson Bay, at Whiteaves Point, and about two miles west of Salt Point, J. B. Tyrrell, 1889 : one specimen from each of these localities.

Most of the specimens obtained at these localities are small and obviously immature, but a single and nearly perfect specimen, collected by Dr. Spencer, is fourteen millimetres in length and nine millimetres in height. In this individual "the body of the shell," as stated by Hall, in his description of *C. Ohioense,* " is marked by about six strong radiating plications on the ventricose portion of the valve, and on each side by more numerous and smaller plications. The interspaces between the ribs are marked by lamellose concentric striæ."

Some palæontologists are of the opinion that *C. Ohioense* is only the young of the *C. trigonale* of Hall, which Professor Hall now regards as a synonym of *C. cuneus,* Conrad.

(S.) CARDIOPSIS TENUICOSTATA. (N. Sp.)

Plate 40, figs. 1 and 2.

Shell of medium size, moderately convex, subcircular or ovately subcircular, inequilateral and a little longer than high. Umbones prominent, beaks incurved, inclined forward and placed in advance of the midlength ; superior border nearly straight but slightly concave in the centre, behind the beaks ; ligamental area narrowly lanceolate in outline, as viewed from above.

Surface marked with numerous fine and closely disposed rounded or flattened radiating ribs, which are crossed by concentric striæ of growth. Muscular impressions and hinge dentition unknown.

Dawson Bay, Lake Winnipegosis, about two miles west of Salt Point, and at the mouth of the Red Deer River, J. B. Tyrrell, 1889 : one imperfect left valve from each of these localities.

The radiating costæ of the larger of these two valves (fig. 1) are about one millimetre broad in their thickest part, and those of the smaller (fig. 2) less than half a millimetre in breadth. In the absence of any knowledge of the hinge dentition of the valves this species is here provisionally referred to *Cardiopsis*, on account of its resemblance in external characters to the *C. radiata* of Meek and Worthen, as figured by Hall,[*] but it may be a *Pararca*. It differs, however, from *C. radiata* in its more nearly circular outline, and in the position of its beaks, which are not placed nearly so far forward.

Three casts of the interior of a shell, collected by Mr. Tyrrell, in 1889, at Whiteaves Point, in Dawson Bay, are also probably referable to *C. tenuicostata*, though they show no traces of the radiating ribs characteristic of the exterior of its test.

(S.) CYPRICARDELLA BELLISTRIATA, Conrad. (Sp.)

Plate 40, figs. 4 and 5.

Microdon bellistriata, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VII, p. 247, pl. xiii, fig. 12.
" " Hall. 1843. Geol. Surv. N. York, Rep. Fourth Distr., p. 196, fig. 2.
" " Hall. 1873. Twenty-third Reg. Rep. N. Y. St. Cab. Nat. Hist., pl. xiv, fig. 8.
Eodon bellistriatus, S. A. Miller. 1877. Cat. Am. Pal. Foss., p. 244.
Microdonella bellistriata, Œhlert. 1881. Mem. Geol. Soc. France, 3rd Ser., vol. II, p. 27, pl. iv, figs. 4a, 4b.
Microdon (Cypricardella) bellistriatus, Hall. 1885. Pal. St. N. York, vol. V, pt. 2, Lamellibr., 2, p. 308, pl. xlii, figs. 17-20; pl. lxxiii, figs. 7-22; and pl. lxxiv, figs. 5-10.
Cfr. *Sanguinolaria lamellosa*, Goldfuss. 1834-40. Petref. Germ., vol. II, p. 279, pl. clix, fig. 12.

Dawson Bay, Lake Winnipegosis, about two miles west of Salt Point, J. B. Tyrrell, 1889 : one mould of the exterior of both valves. Two casts of the interior of a shell which is probably referable to this species, both of which are figured on plate xl, were collected by Mr. Tyrrell, in 1889, in the Upper Devonian shales at Point Wilkins, in Dawson Bay.

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[*] On Pl. lxx, fig. 25, of vol. V, pt. 1, Lamellibr., 2, of the Pal. St. N. York.

(S.) CYPRICARDELLA PRODUCTA. (N. Sp.)

Plate 40, fig. 8.

Shell of medium size, elliptic ovate, about one-third longer than high and very inequilateral; valves compressed convex, moderately inflated, with a faint longitudinal depression immediately above the low, rounded and very indistinctly defined posterior umbonal slope: anterior side extremely short, its margin subtruncated almost vertically below the beaks, as far as the lunule extends, then curving rapidly downward and backward into the ventral margin: posterior side much longer than the anterior, its dorsal and ventral margins broadly and gently convex, and its outer termination narrowly rounded in the centre; umbones compressed and depressed: beaks small, incurved and directed forwards, anterior and nearly, if not quite, terminal: lunule narrowly lanceolate in outline: ligamental area or escutcheon narrow, elongated and well defined.

Surface marked with numerous, close-set and regularly disposed rounded and rib-like concentric plications, which are about equal in breadth to the narrow grooves between them. Hinge dentition and muscular impressions unknown.

Maximum length of the specimen figured, forty-nine millimetres: greatest height of the same, thirty-two mm. and a half.

Dawson Bay, Lake Winnipegosis, at the mouth of Steep Rock River, J. B. Tyrrell, 1889: a mould of the exterior of a left valve, a wax impression of which is figured.

It is just possible that the shell for which the foregoing name is proposed, may prove to be an extreme variety of the preceding species. It seems to most nearly resemble the specimen of *C. bellistriata* from the Chemung Group of the State of New York which Professor Hall figures on plate lxxiv, fig. 5, of volume five, part two (Lamellibranchiata, 2) of the Palæontology of that state, but in that specimen the beaks are represented as not nearly terminal, the anterior end as considerably produced and the posterior extremity as obliquely truncated above and narrowly rounded below.

(S.) CYPRICARDINIA PLANULATA (?) CONRAD, VAR.

Plate 40, fig. 3.

Cfr. *Pterinea planulata*, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII, p. 251, pl. xiii, fig. 15.
Cypricardinia planulata, Hall. 1870. Prelim. Not. Lamellibr., 2, p. 82.
" " " 1883. Pal. St. N. York, vol. V, pt. 1, Plates and Explanations, pl. lxxix, figs. 1-5.
" " " 1885. Ib., Lamellibr., 2, p. 484, pl. lxxix, figs. 1-5.

Dawson Bay, Lake Winnipegosis, a mould of the exterior of a right valve, from the Stringocephalus zone, and Devils Point, on the same lake, a similar mould of a left valve (a gutta percha impression of which is figured), from the basal beds of the Middle Devonian, both collected by Mr. J. B. Tyrrell in 1889.

The specimen from Dawson Bay, which is not figured, is essentially similar in marginal outline to the *C. planulata* as figured by Hall, but the one from Devils Point is more squarely truncated posteriorly and may not belong to the same species. Both differ from the typical form of *C. planulata* in the much greater number and closer disposition of their "concentric undulations."

(S.) GLOSSITES MANITOBENSIS. (Nom. prov.)

Plate 40, fig. 7.

Shell of medium size, strongly but perhaps abnormally compressed at the sides, elongate-subelliptical, a little more than twice as long as high, and very inequilateral. Anterior side very short, its margin curving rapidly and somewhat concavely downward and forward from the beaks to about the midheight, then abruptly backward into the base below; posterior side much longer than the anterior, its extremity very obliquely subtruncated above, and produced as well as narrowly rounded below: ventral margin nearly straight in the centre but curving gradually and rather broadly upward at each end: cardinal margin nearly straight, horizontal and almost parallel with the ventral margin for nearly the whole of its distance, behind the beaks: umbones compressed and depressed: beaks curved inward and forward, placed very near to the anterior end but not quite terminal.

Surface marked apparently with rather numerous, somewhat irregularly disposed, narrow and moderately prominent, rounded concentric plications. Hinge dentition and muscular impressions unknown.

Maximum length of the only specimen collected, forty-six millimetres: greatest height of the same, twenty-one mm.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: a single imperfect specimen with both valves preserved.

This shell has a considerable similarity, in external form, to the *Glossites lingualis* of the Chemung Group of Pennsylvania, as figured by Hall on Plate xcvi of the first part of the fifth volume (Lamellibranchiata, 2) of the Palæontology of the State of New York, but it may not even belong to the same genus. Professor Hall places *Glossites* in the family *Modiomorphidæ*, but the general aspect of the present species suggests that it is more likely to belong to the family *Solenopsidæ* of Neumayr and that it is nearly related to *Sanguinolites*.

(S.) ORTHONOTA CORRUGATA.

Orthonota corrugata, Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 98, pl. v, figs. 4, 4a, and 5. (Separate copies.)

Dawson Bay, Lake Winnipegosis, at Whiteaves Point and on two small adjacent islands, also at the mouth of the Red Deer River, J. B. Tyrrell, 1889 : a few casts or portions of casts of the interior of the shell, on some of which parts of the test are preserved.

SCAPHOPODA.

(S.) DENTALIUM. (Sp.)

(Cfr. D. ANTIQUUM, Goldfuss.)

Plate 45, figs. 1 and 2.

Dentalium antiquum, Goldfuss. 1841-44. Petref. German., vol. III, p. 2, pl. clxvi, figs. 2a, b, c.

A few specimens of a species of *Dentalium*, which cannot at present be satisfactorily distinguished from *D. antiquum*, were collected by Mr. Tyrrell and the present writer in 1888 at Pentamerus and Monroe Points, on Lake Manitoba, and by Messrs. Tyrrell and Dowling in 1889 at Devils Point and at five localities in or around Dawson Bay, Lake Winnipegosis.

A specimen obtained at Pentamerus Point is two inches and a half long, but one of the specimens from Dawson Bay must have been fully three inches in length when perfect. The surface markings of the whole are not well preserved, but appear to consist of transverse annular striations, which are usually very closely disposed, but in some individuals there are indications also of fine longitudinal striæ. It is only proper to add that the specimens from the localities have much the same shape and surface markings as the *Coleolus crenatocinctus* of Hall*, which Whitfield thinks is a *Dentalium*, but there is at present no satisfactory evidence to show that the transverse striæ of the former are crenate.

GASTEROPODA.

(S.) PALÆACMÆA (?) CINGULATA. (N. Sp.)

Plate 43, figs. 8 and 8a.

Shell small, patelliform, erect, conical, but slightly compressed at the sides, considerably elevated, its height being rather more than half the maximum length at the base: apex placed about one-third nearer to one end than to the other, nearly straight, but curved very slightly towards the shorter end: outline of aperture longitudinally subelliptical.

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* Pal. St. N. York, 1879, vol. V, pt. 2, p. 188, pl. xxxii, figs. 1-3, and pl. xxxii A, figs. 3 and 4.

Surface marked with about fifteen or sixteen regularly disposed and nearly equidistant, extremely narrow and very slightly elevated small annular concentric ridges, with flat or somewhat concave and much broader spaces between them: under a lens, too, there are indications of minute radiating striæ. Muscular impressions unknown.

Height of the only specimen collected, eight millimetres; length of the same at the base, fourteen mm.; greatest breadth at base, ten mm.

Dawson Bay, Lake Winnipegosis, at the mouth of the Red Deer River, J. B. Tyrrell, 1889: one nearly perfect cast of the interior of the shell, with a portion of the mould of the exterior of the test of the same specimen.

As the muscular impressions are unknown, it is doubtful whether this shell should be referred to the *Patellidæ* or to the *Capulidæ*. If it belongs to the former of these two families, the apex is of course anterior to the midlength, but if to the latter then the apex would be posterior. The species is here placed provisionally in the genus *Palæacmæa* on account of its general resemblance in external characters to such shells as the *P. typica* of Hall, from the Potsdam sandstone of the State of New York, and to the *P. annulata* of Barrois*, and *P. Barroisii* of Œhlert† from the Devonian rocks of France. The circumstance that the *P. typica* of Hall was first characterized in the "Twenty-third Report on the State Cabinet" in a paper bearing the general title "Descriptions of Devonian Fossils," would seem to have misled Drs. Fischer and Zittel into the statement that the genus *Palæacmæa* was originally based upon a Devonian species.

(S.) PLEUROTOMARIA GONIOSTOMA.

Pleurotomaria goniostoma, Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 99, pl. vi, fig. 1. (Separate copies.)

Dawson Bay, Lake Winnipegosis,—at Whiteaves Point,—on a small island a little to the north-west of Beardy Island,—also at exposures four miles west of Salt Point,—near the mouth of Steep Rock River,—and at the mouth of the Red Deer River, J. B. Tyrrell, 1889: one or two specimens from each of these localities.

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* "Faune du calcaire d'Erbray." Mém. Soc. Géol. du Nord, vol. III, 1889.

† "Sur le Dévonien des environs d'Angers." Bull. Soc. Géol. de France, Ser. 3, vol. XVII, p. 774, pl. xix, figs. 3 and 3a.

(S.) PLEUROTOMARIA INFRANODOSA. (N. Sp.)

Plate 41, figs. 2, 2a and 3.

Shell turbinated, spire short: outer volution much expanded laterally, in adult specimens fully twice as broad as high, subangular above and below and shouldered above, its basal portion concavely and obliquely excavated around the narrow but deep central umbilical perforation. Volutions apparently about three, though the apex is broken off in the few specimens collected, those of the spire rounded and ventricose: outer volution truncated very obliquely backward at the aperture, broadly flattened and somewhat concavely depressed above the shoulder, on the apical side, but with a narrow, rounded and moderately elevated spiral prominence next to the suture,—compressed laterally below the shoulder, on the peripheral region, and broadly as well as concavely constricted just above the basal angulation, which, in one specimen at least (figs. 2 and 2a) bears a single series of large tubercles.

Slit band placed at a short distance below, or anterior to, the shoulder of the outer volution. Surface marked with transverse but flexuous striæ of growth which curve gently backward to the slit band.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: one small specimen, the original of figs. 2 and 2a, with a considerable portion of the test preserved. Dawson Bay, Lake Winnipegosis,—on a small island a little to the north-west of Beardy Island (two characteristic fragments),—at the mouth of Steep Rock River (one large cast of the interior of the shell),—about two miles west of Salt Point (the large cast represented by fig. 3 on Plate xli),—at the mouth of the Red Deer River (two specimens), and at the first small point north of the Red Deer (one fragment): J. B. Tyrrell and D. B. Dowling, 1889.

Not a vestige of the test is preserved on any of the specimens from Dawson Bay. Both this and the preceding species would seem to belong to that group of species of which *Pleurotomaria labrosa*, Hall, is the type, and which Lindström, in his memoir "On the Silurian Gastropoda and Pteropoda of Gothland," calls the Divisio V, *Incisæ*.

(S.) PLEUROTOMARIA. (Sp. Undt.)

Plate 42, fig. 1.

A single cast of the interior of the shell of a reversed or sinistral species of *Pleurotomaria*, which is represented in outline on Plate xlii., was collected by Mr. Tyrrell or the present writer in 1888, at Pentamerus Point, Lake Manitoba. Not a vestige of the test is preserved on this specimen, so that its specific relations cannot be ascertained. The name

Agnesia has been proposed by De Koninck for sinistral species of this genus, but Lindström has shown that some species are both sinistral and dextral.

RAPHISTOMA TYRRELLII. (N. Sp.)

Plate 41, figs. 5, 5a, 6 and 6 a,b.

Shell nearly flat on the apical side, convexly conical and imperforate below, broader than high, spire very slightly elevated, periphery sharply angulated and minutely crenulated. Volutions four or five, those of the spire flattened above, their sides completely covered by the overlapping of those which succeed them, except at the anterior end of the last volution but one, where a very small portion of the upper part of the side is exposed: outer volution shallowly concave above, its peripheral angulation slightly produced on the apical side, in such a way as to form a minute and not very prominent crenulated spiral ridge. Slit band placed on the peripheral angulation of the outer volution and of about equal breadth on each side of it: on the apical side it is concave, but not separated from the rest of the surface by any distinct bordering lines or line, on the umbilical side it is flat but bounded externally by a very minute spiral impressed line: crescents not distinctly defined, but producing the minute crenulations on the periphery.

Surface nearly smooth, marked only by extremely faint lines of growth, which curve convexly backward to the slit band both above and below.

Onion Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: abundant, associated with *Euomphalus Manitobensis*, which is now known to belong to the genus *Omphalocirrus*, and both forms of *Paracyclas elliptica*. Lake Winnipegosis, at Point Brabant, and on the south-western shore of Dawson Bay, at two small points, one about half a mile, the other about three miles north of the mouth of Bell River; also, on Swan Lake, near the mouth of Swan River, and on the Red Deer River, at the Lower Salt Spring, D. B. Dowling, 1888: a few specimens from each of these localities. Collected also by Messrs. Tyrrell and Dowling, in 1889, at many other localities in or around Lake Winnipegosis, as on a small island at the extreme south end of the lake, at Weston Point and a small island off that point, at South Manitou Island, on the south-west side of Cameron Bay, and at eight exposures on the islands or shores of Dawson Bay.

Most of the specimens are mere casts of the interior of the shell, but three examples collected at Dawson Bay in 1889 have the whole of the test preserved, and it is from these that the foregoing description was made. These internal casts, as shown by figs. 6, 6a and 6b on Plate xli, are usually broader, flatter and often much larger than the few testiferous specimens yet collected, such as the original of figs. 5 and 5a on the same plate, and the former are narrowly umbilicated. In testiferous specimens the umbilicus is completely closed by an internal thickening of the shell on that side, the filling of the umbilical cavity being usually the only part of the test left remaining on internal casts.

The species appear to range throughout the whole thickness of the Devonian rocks in this district, but to be more abundant above the Stringocephalus zone than in or below it. It appears to be the Canadian representative of the *Raphistoma Bronni* (Goldfuss, sp.) of the Middle Devonian of Germany and Russia, but differs from that species in its imperforate base, and in the absence of two distant spiral keels or ridges on the apical side of the outer volution.

(S.) MURCHISONIA ARCHIACANA. (Nom. Nov.)

Plates 41, fig. 7, and 45, fig. 3.

Murchisonia angulata, var. A, d'Archiac and de Verneuil. 1842. Trans. Geol. Soc. Lond., Ser. 2, vol. VI, p. 356, pl. xxxii, fig. 7; but not *M. angulata*, Phillips, 1836.

A few specimens of a species of *Murchisonia*, which appears to the writer to be identical with *M. angulata*, var. A, of MM. d'Archiac and de Verneuil, were collected by Messrs. Tyrrell and Dowling in 1889 at Weston Point and at five different localities in or around Dawson Bay, Lake Winnipegosis. Most of the specimens are well preserved moulds of the exterior of the shell, in dolomite, and the figure on Plate xli is taken from a gutta percha impression of one of the most perfect of these moulds, in which, however, only a very small portion, if any, of the body volution is preserved. The original of this figure has nine angular volutions preserved, each encircled with a single (not channeled) spiral keel, which is subcentral on all those of the spire, and there is a "second, less evident keel on the last volution." The other specimen figured, in which the body whorl and two of the preceding volutions are preserved, shows that the maximum breadth of the body whorl at the aperture is as much as an inch and a quarter, that the base is strongly convex and almost or quite imperforate, and that the aperture is somewhat rhomboidal in outline. Only one specimen with the test preserved has as yet been obtained at any of the localities visited by Messrs. Tyrrell and Dowling.

In a paper on some Carboniferous species of *Murchisonia**, Miss Jane Donald states that "considerable confusion has arisen with regard to the identification of the *Murchisonia angulata* of Phillips, owing to his having described three distinct species under this name. In 1836, in the 'Geol. Yorks,' vol. II, p. 230, pl. xvi., fig. 16, Phillips figures and describes two different Carboniferous shells as *Rostellaria angulata* ; and in 1841, in the 'Pal. Foss. of Devon,' p. 101, pl. xxxix, fig. 189, he figures and describes a Devonian shell as *Murchisonia angulata*, identifying it with the shells previously described as *Rostellaria angulata*, and referring them all to the genus *Murchisonia*, d'Arch. and de Vern. This last shell is evidently quite distinct from those first described, being much smaller, and the keels differently disposed ; the only point of resemblance being that both it and the shell figured on the right hand of pl. 'xvi (not xii),' fig. 16, in the 'Geol. Yorks,' are tricarinate." After discussing the relations of the British Carboniferous species of *Murchisonia* to Phillips's *M. angulata*, she goes on to say : " A. d'Archiac and E. de Verneuil and Goldfuss have referred Devonian shells to this species. That of the former differs from both of Phillips's figures ; the more rapid increase of the whorls, and the absence of the keels below the band, distinguish it from the right-hand figure, while the whorls are more excavated than those of the left-hand figure. The shell described by Goldfuss, which I have examined in the Bonn Museum, increases more rapidly ; the band is formed of two keels placed close together and the whorls are more excavated." Koken,* also, states that the *Muricites angulatus* of Schlotheim (1822) is a *Murchisonia*, but that it is quite different to the *Murchisonia angulata* of d'Archiac and de Verneuil.

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* Quart. Journ. Geol. Soc., Lond., vol. XLIII (1887), pp. 621-23.

Under these circumstances, a new name seems to be required for the species now under consideration, and as L. G. de Koninck has already given that of M. de Verneuil to a Carboniferous species, it may not be inappropriate to dedicate this to the memory of his fellow-labourer, the viscount d'Archiac.

(S.) MURCHISONIA DOWLINGII. (N. Sp.)

Plate 41, fig. 8.

Shell elongated, turreted, very slender and many whorled. Volutions thirteen or more, the first three or four rounded or indistinctly angulated, the remainder strongly angulated and distinctly bicarinated considerably below their midlength, the two prominent spiral keels being placed close together and separated by a narrow but rather deep groove, and the centre of the basal or anterior side of the upper keel encircled by an impressed line : sides of the volutions obliquely flattened and somewhat concave both above and below the two spiral keels, but narrowing much more abruptly inward below them ; suture deeply and angularly excavated, its centre occupied by a very fine but deeply impressed line or minute spiral groove.

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* Ueber die Entwickel. der Gastrop. vom Cambrian bis zur Trias. Separat-Abdr. aus dem Neuen Jahrbuch für Mineralogie, 1889, Beilageband VI.

Surface nearly smooth, marked only with very faint but close set incremental striæ, which curve very gently backward on the upper or apical side, and rather more strongly forward on the lower side of the two spiral keels, which form the outer boundaries of the slit band: crescents very indistinctly defined, but apparently as closely disposed as the incremental striæ.

Western shore of Dawson Bay, Lake Winnipegosis, at the mouth of Steep Rock River, D. B. Dowling, 1888: one imperfect but beautifully preserved specimen, with the whole of the test preserved on three of the later volutions. A few sharply defined moulds of the exterior of shells of this species were obtained by Messrs. Tyrrell and Dowling, in 1889, at Weston Point, Lake Winnipegosis; also at Dawson Bay, in the same lake, at Whiteaves Point, on a small island half way between that point and Salt Point, at exposures two miles west of Salt Point, and on the second small point north of the mouth of the Red Deer River. The figure on plate xli. is taken from a gutta percha impression of one of these moulds.

This species appears to differ from the preceding one in its much more slender form, more numerous volutions, and in the circumstance that its spiral keel is not only double, but placed distinctly below the centre of each volution. The writer desires to associate with it the name of its discoverer, Mr. D. B. Dowling, B. Sc., of the Geological Survey of Canada, who collected many of the specimens mentioned in this report.

(S.) BELLEROPHON PELOPS ? Hall, VAR.

Plates 42, figs. 2, 2a and 3, and 45, fig. 4.

Cfr. *Bellerophon* (*Bucania*) *Pelops*, Hall. 1861. Descr. New Spec., Foss., etc., p. 28.
" " " " 1862. Fifteenth Reg. Rep. N. Y. St. Cab. Nat. Hist., p. 56.
" *Bellerophon Pelops*, Hall. 1876. Illustr. Dev. Foss. Gasterop., pls. xx. and xxv.
" " " 1879. Pal. St. N. York, vol. V, pt. 2, p. 95, pl. xxii, figs. 7-13.

Shell subglobose, body volution ventricose and expanded at the aperture: umbilicus apparently closed at all stages of growth, when the test is preserved, though in young or half grown specimens the closing of the umbilicus is clearly not caused by a "callus of the lip" or columellar expansion: outer lip, in the only adult specimen collected, which is an imperfect cast of the interior, apparently shallowly incised at the outer termination of the slit band and broadly rounded on each side, though in immature examples, such as the original of figs. 2 and 2a on Plate xlii, the slit band seems to end anteriorly in a long and narrow slit: centre of the periphery encircled by a narrow and slightly elevated, flattened slit band, which is neither grooved in the middle nor margined on both sides by an impressed line or minute keel.

Surface marked with flexuous raised lines which curve gently and convexly forward on each side of the slit band, and backward to the closed umbilicus.

Western shore of Dawson Bay, Lake Winnipegosis, "from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874: one cast of the interior of the shell. Lake Manitoba, at Monroe and Onion Points, and at an exposure a little to the north of Steep Rock Point, J. B. Tyrrell and J. F. Whiteaves, 1888. Lake Winnipegosis,—at Snake Island, at an island off Weston Point, at South Manitou Island, at Point Brabrant, and at four different exposures in or around Dawson Bay; also on the Red Deer River, a mile and a half above the Lower Salt Spring: J. B. Tyrrell and D. B. Dowling, 1889. One or at the most two specimens were obtained at each of these localities.

Altogether, nineteen specimens were collected, and, of these, thirteen are mere casts of the interior of immature shells, five are either very small or not fully grown specimens with most of the test preserved, and one, as previously stated, is an imperfect cast of the interior of an adult shell. Not a vestige of the columellar callosity of the inner side of the aperture is preserved in any of them.

The whole of the specimens are so imperfectly preserved that it is doubtful whether they should be regarded as specifically identical with *B. Pelops* or not. The only points in which they seem to differ from that species, as described and figured by Professor Hall, are that they seem to attain to a much larger size when adult, and that the closing of the umbilical cavity on both sides of immature individuals is not caused by a spreading over it of the columellar callus. Small specimens of the species now under consideration are very similar, in shape and sculpture, to the *B. propinquus* of Meek*, from the Corniferous limestone of Ohio, but that species is narrowly umbilicated and its slit band is said to be "furrowed along the middle, so as to present a biangular appearance."

(S.) PORCELLIA MANITOBENSIS. (Nom. Prov.)

Plate 42, figs. 4 and 4a.

Perhaps a var. of *Porcellia striata*, Goldfuss. (Sp.)

Cfr. Euomphalus striatus, Goldfuss. 1841–44. Petref. German., vol. III, p. 84, pl. clxxxix, figs. 15, a, b, c.

Pleurotomaria bifida, G. and F. Sandberger. 1850-56. Die Verstein. des Rheinisch. Schichtensyst. in Nassau, p. 185, pl. xxii, figs. 10, 10a, b.

Porcellia striata, Koken, 1889. Ueber die Entwickel. der Gastrop. vom Cambr. bis zur Trias: Sep.-Abdr. aus dem Neuen Jahrbuch fur Mineralog., &c., Beilageband VI., p. 401.

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* Rep. Geol. Soc. Ohio, vol. I, pt. 2 (1873) p. 226, pl. xx, figs. 4a, b.

Shell discoidal, composed of three or four rounded volutions, which appear to be coiled on nearly the same plane and are in contact throughout their entire length, but partially separated on both sides by a deep suture and almost free: umbilicus wide and open, exposing all the inner whorls. Outer volution very slightly expanded at the aperture, in the largest specimen collected (the one figured): its periphery encircled with a narrow slit band, in the form of an obtuse central carina: aperture circular.

Surface very minutely, closely, and transversely but somewhat obliquely costulate on each side of the slit band: test extremely thin.

Maximum diameter of the largest specimen collected, forty millimetres: diameter of its aperture, sixteen mm.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: the specimen figured. Dawson Bay, Lake Winnipegosis, at Whiteaves Point (one specimen), at a small island half way between that point and Salt Point (one specimen), at Beardy Island (one specimen) and at the south end of Rowan Island (four specimens); J. B. Tyrrell and D. B. Dowling, 1889.

Of the eight specimens collected, one is small and very imperfect but wholly testiferous, four are casts of the interior of the shell, with portions of the test preserved on either or both sides of the slit band, but not actually upon it, and the rest are sharply defined moulds of the exterior of the shell. The nuclear volution is not preserved in any of these specimens, and in casts of the interior the slit band appears as a narrow rounded and not much elevated spiral ridge with a linear groove on each side of it.

As it is doubtful whether these few and imperfect specimens are or are not actually conspecific with *P. striata*, it is thought desirable to designate the former by a local and provisional name. The only differences, however, that the writer has yet been able to detect between *P. Manitobensis* and *P. striata* are that the former appears to attain to a much larger size than the latter, and to be slightly expanded at the aperture in the adult state.

In the Geological Magazine for May, 1891, Mr. R. B. Newton proposes to change the name *Porcellia* of Léveillé (1835) to *Leveillia*, on account of the circumstance that that of *Porcellia* had been given by Latreille in 1804 to a genus of Isopods. Still, the substitution of a new name for one with which palæontologists have become familiar by long usage, seems to the writer a greater inconvenience than would result from the use of two similar but not identical names, in such widely different divisions of the animal kingdom as the Mollusca and Arthropoda.

(S.) EUNEMA SPECIOSUM. (N. Sp.)

Plate 42, fig. 5.

Shell ovate turbinate, a little longer than broad, base ventricose, imperforate; spire moderately elevated, but shorter than the outer volution, which is encircled with six nodulose ridges or spiral keels. Volutions about five, the two apical ones obliquely compressed, the third and fourth angulated both above and below, and encircled with two distant nodulose spiral ridges, with a shallowly concave oblique depression between them; outer volution bearing one prominent nodulose spiral ridge near the suture, on the apical side,—another a little above or behind its midlength, with a broad, obliquely, flattened and shallowly concave depressed zone between them,—a third, at a short distance below or in advance of the second,—and three similar but smaller and more closely disposed nodulose ridges around the centre of the base; suture angular and deeply impressed; aperture nearly circular; outer lip simple; columellar lip thickened and somewhat reflected below.

Surface marked by transverse but somewhat oblique lines of growth, in addition to the nodulose or tuberculated spiral keels.

Dawson Bay, Lake Winnipegosis, at Whiteaves Point and on two small islands west and south-west of that point, at an exposure about two miles west of Salt Point and at the mouth of Steep Rock River, J. B. Tyrrell and D. B. Dowling, 1889; a few specimens from each of these localities.

Most of these specimen are well preserved moulds of the exterior of the shell, in dolomite, with casts of the interior in place, the intermediate test being absent. Three of the specimens, however, are entirely testiferous. The largest example collected, when perfect, must have been fully ~~ten~~ inches in length. The nodules or tubercles on the spiral ridges of the later volutions are very feebly developed in half-grown shells, but on the outer volution of adult individuals they are moderately elevated, rounded, conical and placed at distances apart about equal to or a little greater than their own diameters at the base. Casts of the interior of the shell are perforated by a narrow but deep umbilicus.

two /

The species has much the same shape as the *Eunema capitaneum* (=*Turbo capitaneus*, Goldfuss), but in that species the outer volution is encircled by five comparatively large nodulose ridges, which alternate with five rows of smaller tubercles.

(S.) EUNEMA BREVISPIRA. (N. Sp.)

Plate 42, figs. 6 and 7.

Shell turbinated, spire short, about equal in height to one-half of that of the outer volution near the aperture: base ventricose, imperforate: outer volution encircled by three rows of transversely elongated tubercles. Volutions five, the first, second and third obliquely compressed and the fourth with nearly vertical sides, the third and fourth encircled with two rows of tubercles, one next to the suture above, and the other, which is partially overlapped by each succeeding volution, at the suture below: outer volution considerably inflated, obliquely flattened or concavely constricted above the midheight and ventricose below, encircled with one row of from twelve to fourteen crescentic or spout-shaped, elevated tubercles close to the suture above, with a second row of somewhat similar but much more elongated tubercles a little below the midheight, and with a third row of more feebly developed elongated tubercles around the base, which radiate from its centre. Aperture broadly rounded on the outer side, more narrowly rounded at the base, its columellar side obliquely and concavely emarginate by a slight encroachment of the preceding volution: outer lip simple: columellar lip slightly thickened.

Surface marked by fine transverse striæ or lines of growth, in addition to the rows of tubercles. Casts of the interior of the shell have regularly ventricose volutions with a deeply channelled suture, and the base of each is perforated by a narrow but very deep umbilicus.

Western shore of Dawson Bay, Lake Winnipegosis, at an exposure four miles west of Salt Point (three specimens), and at the mouth of the Steep Rock River (one specimen); D. B. Dowling, 1888. Lake Winnepegosis, on the south-western shore at Weston Point (two specimens), and on the south-eastern shore at Net Point (five specimens),—also in Dawson Bay, at Whiteaves Point (abundant), at exposures two and four miles west of Salt Point (four specimens), on a small island three miles north of that point (one specimen), and at the mouth of the Red Deer River (one specimen); J. B. Tyrrell and D. B. Dowling, 1889.

This species, like the last, is represented almost exclusively by sharply defined moulds of the exterior of the shell, with corresponding casts of the interior, the intermediate test not being preserved. The figures on Plate xlii are drawn from gutta percha or wax impressions of two of these natural moulds. One completely testiferous specimen, however, was obtained at Dawson Bay. In its short spire and ventricose outer volution *E. brevispira* shows a certain amount of similarity to the *E. cœlatum* (= *Turbo cœlatus*, Goldfuss) of the Devonian rocks of the Eifel, but the latter shell is much the smaller of the two, and their sculpture is entirely different.

(S.) EUNEMA SUBSPINOSUM. (N. Sp.)

Plates 42, fig. 8, and 45, fig. 5.

Shell small, turbinated, somewhat conical, a little longer than broad: spire moderately elevated but shorter than the outer volution, base apparently imperforate. Volutions three, or perhaps four, the apex being rather imperfectly preserved in the few specimens collected, increasing rapidly in size, the nuclear ones small and apparently smooth, the last but one obliquely compressed above, rounded below and encircled with six close-set, regularly disposed, fine tuberculated spiral ridges; outer volution much broader than high, broadest near the base, somewhat compressed above, truncated obliquely at the aperture and encircled with six or more spiral rows of tubercles, some of which are spinose or subspinose, especially those on the upper row and those on the lowest: suture deeply impressed.

Surface marked by oblique lines of growth which run parallel to the outer lip. In one specimen, also, there are indications of a minute raised line between each pair of rows of tubercles on the outer volution.

Approximate dimensions of the most perfect specimen collected: height about twelve millimetres; maximum breadth of the outer volution, about ten mm.

Dawson Bay, Lake Winnipegosis, at the mouth of the Red Deer River, D. B. Dowling, 1888, about two miles west of Salt Point, and at the first small point north of the mouth of the Red Deer River, J. B. Tyrrell, 1889: one well preserved mould of the exterior of the shell from each of these localities. The figure represents a gutta percha impression taken from one of these natural moulds.

(S.) EUNEMA CLATHRATULUM. (N. Sp.)

Plate 42, fig. 9.

Shell small, turbinated, somewhat turreted, height a little greater than the maximum breadth, spire rather higher than the outer volution, which is nearly twice as broad as high, base imperforate. Volutions five, increasing much more rapidly in breadth than in height, the first, second and third comparatively slender, the fourth considerably expanded,—the second, third and fourth obliquely compressed above, angular or sub-angular in the centre, and with nearly vertical sides below: suture distinctly defined: outer volution ventricose and much expanded laterally, somewhat flattened at the base.

Surface marked by fine spiral ridges, which are crossed by very numerous, close-set, regularly disposed and nearly straight, minute laminar costulæ, the points where the former are intersected by the latter being minutely tuberculated, when examined under a lens. In the specimen figured, which though unusually perfect, is not more than half grown, there are two or three distant spiral ridges on the last volution but one, and six or seven on the last, but in larger though less perfect individuals there are nearly if not quite twice this number on the corresponding volutions.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: a single nearly perfect but not very well preserved testiferous specimen. A few sharply defined moulds of the exterior of shells of this species were collected by Messrs. Tyrrell and Dowling, in 1889, at Dawson Bay, Lake Winnepegosis, on a small island near Beardy Island, at the mouth of Steep Rock River, about two miles west of Salt Point, and at the mouth of the Red Deer River.

ASTRALITES. (Gen. Nov.)

Shell conical, imperforate, flattened at the base, periphery sub-angular, in the only species known fringed with a thin, regularly lobate or sinuate lateral expansion: columella or internal axis encircled with a single, narrow but prominent spiral fold, which is represented by a deep spiral groove in casts of the interior.

The shells for which this new generic name is proposed are essentially similar in their external characters to some recent species of the subgenus *Uvanilla*, of the genus *Astralium*, especially to the *U. unguis* of Mawe, from south-west Mexico. They bear, also, a considerable resemblance to the *Onustus* (*Haliphœbus*) *alatus* of Koken,* from the Devonian rocks of Germany, and to the "alate" *Pleurotomariœ*. They differ, however, from *Uvanilla*, *Onustus*, *Pleurotomaria* and any other genus that the writer is acquainted with, in the presence of a conspicuous fold upon the columella.

The peripheral alation of the outer volution of the typical species of this genus is indicated or preserved in only two of the specimens collected. One of these is an unusually perfect and well preserved mould of the exterior of nearly the whole of the upper surface of the shell. Figure 10 on Plate xlii was drawn from a gutta percha impression of this mould, but a still better impression from it, which shows nearly the whole of the upper side of the peripheral alation, and which is represented on Plate xlv, fig. 6, has since been obtained in wax. The other is the testiferous specimen figured on Plate xlii, fig. 10a, in which the upper or apical portion is buried in the matrix and only the base exposed. From these two specimens it is impossible to ascertain whether the peripheral alation is formed of two thin lamellæ which coalesce at their summit and enclose the slit band,—or solid throughout. If it encloses a slit band, the affinities of the genus are probably with the alate species of *Pleurotomaria* for which Ferdinand Roemer proposed the genus *Euomphalopterus*, but if solid, with *Astralium* or the *Onustidœ*.

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* Neues Jahrb. für Mineral., Geol. und Palæont., 1889, Beilageband VI, p. 437, pl. xi, figs. 10 and 11.

Plagiothyra, Whidborne,* has a tooth but not a fold on the columellar lip, but the *Littorina alata* of G. and F. Sandberger,† which is probably also a *Plagiothyra*, as it too has a tooth on the columellar lip, is very similar in shape and ornamentation to the type of *Astralites*.

(S.) ASTRALITES FIMBRIATUS. (N. Sp.)

Plates 42, figs. 10, 10a, 11 and 11a, and 45, fig. 6.

Shell with a moderately elevated spire, which is about equal in height to the outer volution. Whorls five, those of the spire obliquely compressed, the third and fourth with a sinuous subspinose frill at the suture below, the outer one sub-angular at the periphery and encircled with a prominent, thin, laminar and flexuous subspinose keel: base shallowly depressed in the centre: suture indistinct.

Surface of the upper or apical side marked with numerous, close-set and rather regularly disposed spiral raised lines, and with broad faint radiating plications, the centre of that part of the outer volution being partially encircled by a row of about six obscurely defined, low, distant tubercles: lower surface or base marked with fine oblique lines of growth exteriorly, but smooth in the central depression.

In casts of the interior of the shell, the suture is deeply impressed, the periphery narrowly rounded and the base deeply umbilicated.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: one very young specimen. Dawson Bay, Lake Winnipegosis, four miles west of Salt Point (two specimens), and at the mouth of the Red Deer River (one specimen), D. B. Dowling, 1888. A few specimens, also, were collected by Mr. J. B. Tyrrell, in 1889, from Dawson Bay, at Whiteaves Point, at the mouth of Steep Rock River, four miles west of Salt Point, and at the mouth of the Red Deer River.

The specimens so far obtained at these localities consist of numerous casts of the interior of the shell, a few moulds of the exterior, in dolomite, and a single testiferous specimen (fig. 10a) in which only the base is exposed. All the internal casts, such as the one represented by figs. 11 and 11a on Plate xlii, show the characteristic spiral groove in the umbilical perforation, caused by the plication of the columella.

(S.) EUOMPHALUS (STRAPAROLLUS) ANNULATUS, Phillips.

Plate 43, figs. 1, 1a and 2.

Euomphalus annulatus, Phillips. 1841. Pal. Foss. Cornw., Dev. and W. Somers., p. 138, pl. lx, fig. 170*.

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*Mon. Devon. Faun. S. England, vol. I, p. 264.

†Verstein. Rheinisch. Schichtensyst. Nassau, 1850-56, p. 219, pl. xxv, figs. 14, 14a-c.

Euomphalus annulosus, Phillips. 1841. Ib., p. 231.

Euomphalus annulatus, Whidborne. 1891 and 1892. Devon. Faun. S. of England, vol. I, pp. 250-51, (which see for a complete list of the synonyms of European examples of this species) pl. xxiv, figs. 6 and 6a.

"Western shore of Dawson Bay, from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874: two or three worn specimens.

Lake Manitoba, at Monroe and Pentamerus Points, J. B. Tyrrell and J. F. Whiteaves, 1888: abundant. A few specimens, also, were collected by Messrs. Tyrrell and Dowling, in 1889, on the eastern and western shores of Dawson Bay, Lake Winnipegosis, and on four small islands in the southern portion of that bay.

One of the specimens collected by Dr. Spencer has the volutions partially uncoiled and approaches *Phanerotinus*, while one of those obtained by Mr. Tyrrell in Dawson Bay, seems intermediate in its characters between *E. annulatus* and *Philoxene serpens*, Phillips (sp.).

On page 257 of the present Report (lines 15 and 16 from the top) the words: "the *Euomphalus* is a small species of *Straparollus* here described and figured as *S. filicinctus*" should be cancelled and the following words substituted:—the *Euomphalus* is *E. annulatus*, Phillips. The writer had given the manuscript name *Straparollus filicinctus* to the specimens collected by Dr. Spencer, before the fourth part of the first volume of Mr. Whidborne's Monograph of the Devonian Fauna of the South of England had been received in Ottawa, but from the detailed description of *E. annulatus* in that memoir, it has since become apparent that they are referable to that species.

EUOMPHALUS (PHANEROTINUS). Sp. Undt.

Plate 43, figs. 3 and 3a.

Lake Winnipegosis, on a small island off Weston Point, J. B. Tyrrell, 1889: a single cast of the interior of the shell. The specimen, which consists of rather less than one complete volution, is fully two inches in its maximum diameter and circular in transverse section. It is not unlike the shell which Goldfuss figures on Plate cxci, figs. 1a and *e*, of the third volume of the Petrefacta Germaniæ, as *Euomphalus serpula*, DeKoninck, var. *teres*, but which De Koninck considers the typical form of that species. It also closely resembles the large specimen of *Euomphalus (Phanerotinus) laxus* figured by Hall on Plate xvi, fig. 9, of vol. V, pt. 2, of the Palæontology of the State of New York, but it may prove to be only a partially uncoiled variety of some at present unknown species, whose volutions are usually in contact.

EUOMPHALUS (CIRCULARIS? Phillips, var.) SUBTRIGONALIS.

Plate 43, fig. 4.

Cfr. *Euomphalus circularis*, Var. Whidborne. 1891. Mon. Dev. Fauna S. England, p. 249, vol. I, pl. xxiv, figs. 9 and 9a.

Shell, or rather cast of the interior of the shell, depressed turbinate, almost discoidal: spire low, in the majority of specimens raised very little above, but occasionally depressed below, the highest level of the outer volution: base obliquely and concavely excavated, as well as widely umbilicated. Volutions about four, though the apex is not preserved in any of the specimens collected, those of the spire depressed convex, the outer one widely expanded, more than twice as broad as high, subtriangular in transverse section, flattened above, laterally compressed on the periphery, subangular at the shoulder above and around the umbilical margin below: umbilicus wide but shallow, exposing the basal side of each of the inner volutions: suture channeled and distinctly defined: aperture ovately subtriangular, narrow and obtusely pointed at the base below.

Surface markings unknown, not a vestige of the test being preserved on any of the specimens collected, which are all mere casts.

It is not practicable to give very accurate proportional dimensions of any of these casts, but the figure on plate xlvii. is of the natural size.

Onion Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: four specimens. Lake Winnipegosis, at its southern extremity, on Charlie and Snake Islands, and at two exposures on the adjacent shore, also in Dawson Bay, on Beardy Island and at Point Wilkins, J. B. Tyrrell, 1889; from one to six specimens at each of these localities. All from the limestone immediately overlying the Stringocephalus zone.

The precise specific relations of these specimens must remain doubtful until examples with at least some portion of the test preserved are collected. In the meantime all that can be said about these casts is that they correspond very well with the description of "decorticated" specimens of one of the varieties of the *Euomphalus circularis* of Phillips figured in the monogragh cited above. They are also somewhat similar in shape to the *E. trigonalis*, of Goldfuss, but the outer volution of each is not nearly so sharply angulated either above or below, and their apertures, in consequence, are not so distinctly triangular in outline.

(S.) OMPHALOCIRRUS MANITOBENSIS.

Plate 43, figs. 5, 6 and 7.

Euomphalus Manitobensis, Whiteaves. 1890. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 100, pl. vi, figs. 2, 2a-b and 3, 3a. (Separate copies.)

Shell large, discoidal, concave on both sides, but rather more deeply concave above* than below: spire sunk: umbilicus extremely wide and open. Volutions five when perfect, though the nuclear one is not preserved in any of the specimens collected, in contact but very slightly embracing, coiled on nearly the same plane, those of the sunken spire depressed convex above, the last whorl but one subangular below and encircled on its outer margin with a row of tubercles close to the suture. Outer volution angular or subangular and encircled by from thirteen to nineteen, or, in unusually large specimens, by as many as twenty-six, large, arched and more or less spout-shaped nodes or tubercles at the shoulder above and on the umbilical margin below, the rather broad and comparatively smooth zone between these two rows of nodes being compressed obliquely inward and downward: suture deeply impressed on both sides: aperture subcircular: test apparently rather thick.

Surface marked with flexuous lines of growth, which curve obliquely and concavely forward both above and below and very gently but convexly forward across the zone between the two rows of tubercles on the outer volution. In well preserved specimens these incremental lines are so prominent, numerous and close-set upon the upper surface as to give it a distinctly costulate appearance, while in half-grown testiferous specimens the outer zone between the two rows of tubercles is minutely and densely but very regularly granulose.

Operculum calcareous, moderately thick, nearly flat internally, slightly convex externally, circular in outline and multispiral.

In the Stringocephalus zone at Pentamerus Point, Lake Manitoba, at many exposures on the shores and islands of Dawson Bay, Lake Winnipegosis, and on the Red Deer River, between the Lower and Upper Salt Springs, where it was collected by J. B. Tyrrell, J. F. Whiteaves and D. B. Dowling in 1888 and 1889.

In the limestone immediately above the Stringocephalus zone at Onion (*not* Monroe) Point, Steep Rock Point and at an exposure north of Steep Rock Point, Lake Manitoba; at Lake Winnipegosis, on its southern shore two miles west of Meadow Portage,—on Charlie, Snake and South Manitou islands and on a small island off Weston Point, at Point Brabant, on the west side of Cameron Bay, and at a few exposures on the shores and islands of Dawson Bay; also, on the Red Deer River at or near the Lower Salt Spring. At each of these localities it was obtained in more or less abundance by Messrs. Tyrrell, Dowling and the present writer in 1888 and 1889.

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* As the nucleus is unknown, it is uncertain whether the shell is dextral or sinistral. In the above description it is assumed to be dextral, but, should it prove to be sinistral, the terms "above" and "below," "spire" and "umbilicus," will, of course have to be reversed.

Most of the specimens from the Stringocephalus zone are natural moulds of the exterior of the shell, with the surface characters fairly well preserved, and it is from wax impressions of several of these moulds (two of which are figured) and from two small testiferous examples, that the foregoing description was made. The specimens from the limestone immediately above the Stringocephalus zone, on the other hand, are mere casts of the interior of the shell, most of which are very badly preserved, together with a few opercula, and it was upon these casts and opercula that the description and figures of *Euomphalus Manitobensis* were based. One of these casts is so broken as to show the operculum in situ, though a little displaced from its natural position, but none of them show the characters of the lower side at all well. Before these angulated and nodose moulds of the exterior of the shell were very critically studied, they were regarded by the writer as not only specifically but also subgenerically distinct from the comparatively rounded, smooth and frequently depressed internal casts for which the name *E. Manitobensis* was proposed, but they are now all regarded as different states of preservation of a single species of *Omphalocirrus.* The angulation and peculiar tuberculation of the outer volution, as seen in moulds of the exterior or in testiferous specimens, is obviously caused by a thickening and plication of the outer layer of the test and does not affect the inner layer, while the depression of many of the internal casts, especially that of the type of *E. Manitobensis* figured in the Transactions of the Royal Society of Canada, is evidently abnormal, as the operculum shows that the aperture must have been circular in outline when undistorted.

The type of the genus *Omphalocirrus* of De Ryckholt (1860) is the *Euomphalus Goldfussi* of d'Archiac and de Verneuil, but in that species the outer volution is angulated and tuberculated on one side only, and the whole shell is more deeply concave above than below. According to Fischer*, *Coelocentrus,* Zittel (1882) is a synonym of *Omphalocirrus.*

(S.) STRAPAROLLINA OBTUSA. (N. Sp.)

Plate 42, figs. 12, 12a and 13.

Shell turbinated, somewhat conical, its height a little greater than its maximum breadth: spire elevated, rather higher than the outer volution, and obtuse at its apex: base deeply umbilicated. Volutions seven or eight, the earlier or apical ones depressed convex, the later or lower whorls of the spire moderately convex but somewhat compressed laterally,—the outer volution rounded, slightly inflated and gradually expanding, more than twice as broad as high: umbilicus occupying nearly one-half of the total diameter of the base, though the umbilical margin is rounded and very indefinite: suture deeply impressed: aperture apparently subcircular.

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*Manuel de Conchyliologie, Paris, p. 829.

Surface marked by numerous minute spiral raised lines, which are crossed by equally minute but much more numerous and closely disposed flexuous transverse ridges. Under a lens, these latter are seen to curve gently backward on each side of the periphery, where each one forms a shallow sinus, and to be tuberculated at the points where they pass over the spiral lirulæ.

The approximate dimensions of the specimen represented by figs. 12 and 12a, which is a remarkably perfect cast of the interior of the shell, are as follows, as measured in the centre of the dorsal surface: entire height, 18·75 millimetres; height of last volution, 8·7 mm.; breadth of the same, 18 mm.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: seven specimens. Dawson Bay, Lake Winnipegosis,—on the southwest shore two miles west of Salt Point,—on the west shore, at the first small point north of the Red Deer River, at the south end of Rowan Island,—and on three small islands in the southern portion of the bay, J. B. Tyrrell and D. B. Dowling, 1889: a few specimens, some with considerable portions of the test preserved, from each of these localities.

This very distinct species is evidently congeneric with the *Straparollina asperostriata*, *S. Circe* and *S. Eurydice* of Billings*, from the Black River limestone of Paquette's Rapids, on the Ottawa River. It is not very dissimilar, in general form, to *S. Eurydice*, but its sculpture is more like that of *S. asperostriata*. The genus is represented in the Lower Cambrian by the *S. remota*, Billings, of the Olenellus zone of Newfoundland, in the "Quebec Group" of that island by *S. pelagica*, Billings, and in the Black River limestone of Canada by the three species already enumerated. In the writer's judgment, the "*Straparollus Daphne*" of Billings, from the Guelph limestone of Ontario, is also a *Straparollina*.

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*Described in the Can. Nat. & Geol., 1860, vol. V, pp. 161-62, and figured on p. 144 of the Geol. Canada (1863).

(S.) PSEUDOPHORUS TECTIFORMIS. (N. Sp.)

Plate 44, figs. 1 & 1a.

Shell subconical, spire elevated, outer volution widely expanded, sharply angulated below and truncated very obliquely at the aperture: base flattened, imperforate. Number of volutions unknown, only the outer one and a portion of the last but one being preserved in the most perfect specimen collected, the penultimate one considerably elevated, moderately convex, rounded above, slightly compressed in the centre, and faintly concave next to the suture below. Outer volution nearly three times as broad as high, also rounded above and obliquely compressed below: aperture large and apparently somewhat triangular in outline: outer lip thin, produced above and receding beneath, its lower portion concavely emarginated.

Surface marked with close-set imbricating lamellar striæ of growth, which curve somewhat convexly and very obliquely backward and downward on the apical side of the outer volution, and obliquely but concavely backward below.

Dawson Bay, Lake Winnipegosis, about two miles west of Salt Point, J. B. Tyrrell, 1889: one imperfect specimen with the test preserved. A specimen of essentially similar shape and size, but whose surface is encircled by numerous small spiral ridges, in addition to the oblique lines of growth, and which therefore may not belong to the same species, was collected by Mr. Tyrrell in the same year on a small island in Dawson Day, about half way between Salt and Whiteaves Points.

The name *Pseudophorus* was proposed by Meek in 1873* for an "undescribed group of shells," the type of which is a remarkable species from the Corniferous limestone of Ohio, which he provisionally described and figured under the name *Xenophora*? (*Pseudophorus*) *antiqua*, Meek. This shell, Mr. Meek writes, "is almost certainly not a *Trochita*, because the broad underside does not have the character of a mere spiral lamina within the margin, but is really the lower side of the body volution. It seems to be more nearly related to *Xenophora*, Fischer (= *Phorus*, Montfort) or *Onustus*, Humphrey; but differs from both in not having the habit of attaching foreign bodies around its periphery, as well as in wanting the distinct umbilicus of the latter."

The comparatively elevated form together with the much more convex and almost dome-shaped volutions, of *P. tectiformis*, will at once enable that species to be distinguished from *P. antiquus*.

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* Rep. Geol. Surv. Ohio, vol. I, pt. 2, Palæontology, p. 222.

(S.) PLATYCERAS (ORTHONYCHIA) PARVULUM. (N. Sp.)

Plate 43, figs. 9, 10 and 11.

Shell very small for the genus, nearly straight and somewhat conical, but compressed at the sides, unsymmetrical and rather irregular in shape, the posterior dorsal slope being usually more convex than the anterior, height varying in different specimens from a little greater to rather more than one-third greater than the maximum diameter at the base: apex obtusely pointed, almost erect but with a slight forward inclination: aperture narrowly subelliptical, nearly twice as long as high, lip slightly irregular in outline, but always with a deep concave sinus on each side, and produced convexly downward and a little outward in front and behind.

Surface markings consisting apparently of concentric lines of growth, which run parallel to the outer lip. Muscular impressions unknown.

Dimensions of the largest specimen collected: maximum height, twelve millimetres: greatest length at the base, eight mm.: breadth of aperture, five mm.

Dawson Bay, Lake Winnipegosis, on a small island north of Whiteaves Point (one specimen, the original of fig. 11), and on another south-west of that point (two specimens, represented by figs. 9 and 10); J. B. Tyrrell, 1889.

The few specimens collected are all mere casts of the interior of the shell. These appear to represent a small and aberrant or abnormal and previously undescribed species of the subgenus *Orthonychia*, most closely related to the *Platyceras* (*Orthonychia*) *conoideum* of Goldfuss, from the Stringocephalus limestone of the Eifel and Nassau, as figured by Frech.*

(S.) PLATYOSTOMA TUMIDUM. (N. Sp.)

Plate 43, fig. 12.

Shell subglobose or broadly subovate, imperforate, spire small and very short, raised very little or not at all above the highest level of the outer volution. Volutions apparently about three (though the apex is imperfect in all the specimens collected) rounded, increasing very rapidly in size and closely embracing, by far the greater portion of the earlier ones being covered by the overlapping of those which succeed them: outer volution regularly convex, very ventricose and widely spreading, especially at and near the aperture, a little depressed below the suture, broader than high, broadest above the midheight, slightly produced and rather narrowly rounded at the base: aperture apparently not far from circular.

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* Zeitschr. der Deutsch. geolog. Gesellschaft, 1891, vol. XLIII, p. 678, pl. xliv, figs. 6, 6a–c.

The only surface markings that happen to be preserved consist of rather closely disposed, flexuous and oblique striæ of growth.

Dimensions of the most perfect specimen collected: entire height, as measured from a horizontal line drawn on the same level as the apex, to the centre of the base, twenty-four millimetres: greatest height of the outer volution twenty-two mm.: maximum breadth of the same, twenty-five mm.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: three specimens, in each of which most of the test is exfoliated, only a few small fragments of its outer surface being preserved.

This shell has a much narrower and smaller spire than the *P. lineatum* of Conrad, the diminished size of the spire in the former being obviously due to the greater amount of overlap in the outer volutions.

(8.) NATICOPSIS MANITOBENSIS. (N. Sp.)

Plate 45, fig. 7.

Shell imperforate, turbiniform, subglobose, a little higher than broad: spire elevated, occupying at least one-fourth, and in some specimens nearly one-third, of the entire height. Volutions about four, convex, regularly rounded and increasing rather rapidly in size, the outer one large and ventricose: aperture subovate: outer lip thin and simple.

Surface markings consisting of numerous, regularly and closely disposed, but very slightly elevated, minute raised lines, or faint and crowded, narrow, thread-like plications, which are too small to be seen without the use of a lens, and which cross the volutions obliquely.

As the nuclear volution is broken off in each of the specimens collected, it is impossible to give very accurate measurements of any of them, but the one figured is represented as twice the natural size, and the largest specimen upon which any of the characteristic surface ornamentation is preserved was probably nearly or quite eighteen millimetres in height when perfect.

Lake Manitoba, at Pentamerus Point (eleven specimens), and Monroe Point (two specimens); J. B. Tyrrell and J. F. Whiteaves, 1888.

It is doubtful whether this species and the next should be referred to *Naticopsis* or *Natica*. The opercula of both of these species are unknown, and there is no evidence that the columellar lip of either was flattened or transversely striated, as in *Naticopsis*, but in the most perfect specimens of both, the aperture is filled with the matrix and the columella almost completely covered. Deshayes and others have maintained that the genus

Natica occurs as far back as the Silurian epoch, and the recent discovery of paucispiral and possibly naticoid opercula in the Guelph limestone of Ontario seems to the writer to afford strong presumptive evidence of the correctness of this conclusion. Still, as the occurrence of the genus *Natica* or of any of its subgenera, in rocks of Palæozoic age, cannot at present be satisfactorily proved, it is thought better to refer this and the next species to *Naticopsis.*

The surface markings of the present species appear to be essentially similar to those of the *Naticopsis æquistriata* of Meek,* from the Corniferous limestone of Ohio, and of the *Natica antiqua* of Goldfuss,† from the Devonian rocks of Germany and England. According to Mr. Meek, however, the *Naticopsis æquistriata* is less than five millimetres in height, broader than high, with a depressed spire. *Natica antiqua,* also, has a shorter spire than that of *Naticopsis Manitobensis,* and a much more expanded outer volution.

(S.) NATICOPSIS INORNATA. (N. Sp.)

Plate 43, fig. 14.

Shell imperforate, ovately subglobose, the height and breadth being nearly equal, spire short, conical, occupying rather more than one-sixth of the entire height. Volutions about four, increasing rapidly in size, those of the spire obliquely compressed, the outer one large, obliquely expanding and increasing rapidly in height, as well as breadth, toward the aperture, its base narrowly rounded and somewhat produced: aperture subovate, outer lip thin and simple.

Surface nearly smooth, and showing only a few obscure lines of growth.

Dimensions of the largest and most perfect specimen obtained, the one figured: maximum height and greatest breadth, each about twenty-three millimetres and a half: height of spire, as measured on the median line of the dorsal surface, four mm.

Dawson Bay, Lake Winnipegosis, on a small island north north-west of Beardy Island, J. B. Tyrrell, 1889: one nearly perfect specimen, with the test preserved, the original of fig. 14 on plate xliii. A few casts of the interior or moulds of the exterior of shells apparently referable to this species, were collected by Messrs. Tyrrell and Dowling, in 1889, in Dawson Bay, at Whiteaves Point, on a small island three miles north of Salt Point, at the mouth of Steep Rock River, about two miles west of Salt Point, and at the first small point north of the mouth of the Red Deer River.

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*Geol. Surv. Ohio, 1873, vol. I, pt. 2, p. 216, wood cuts a, b.

†Petref. Germ., vol. III, 1841-44, p. 117, pl. cxcix, figs. 2 a, b.

The distinguishing features of this species, as compared with those of *N. Manitobensis*, are the shorter and more conical spire of the former, its obliquely expanding outer volution and different surface markings.

LOXONEMA, Phillips.

The most typical species of *Loxonema*, as described by Phillips and others, are no doubt those whose surface is marked by sigmoidally arched costulæ or crowded growth lines, parallel to the outer lip. Still, the fact that Phillips himself, on page 139 of his "Palæozoic Fossils of Cornwall, Devon and West Somerset," included in that genus his own *L. reticulatum*, whose whole surface is stated to be "reticulated by raised longitudinal and spiral threads," evidently shows that he intended the original diagnosis of the genus to be enlarged so as to include those species which are marked also with spiral ridges or keels. The few species collected by Messrs. Tyrrell and Dowling may therefore be arranged in two groups, as follows.

A. Typical and non-reticulate species, whose surface is either marked only with sigmoidal costulæ, or growth lines, parallel to the outer lip, or nearly smooth.

LOXONEMA ALTIVOLVIS. (N. Sp.)

Plate 45, figs. 8 and 9.

Shell rather large, elongate, subulate: volutions compressed laterally, but slightly convex in the middle, the later ones of the spire about as high as broad, the earlier ones unknown: outer volution considerably higher or longer, but apparently not very much broader than the one which immediately precedes it: suture indistinctly defined and devoid of band in the few specimens upon which the test is preserved, but deeply channeled in casts of the interior: aperture subovate, higher than broad, attenuate above and narrowly rounded below.

Surface finely costulate and marked with closely and regularly disposed, slightly flexuous and simple raised lines, which cross the volutions transversely. Upon the later volutions of the spire and upon the upper and central portion of the outer volution, these raised lines are nearly straight or faintly concave, but on the base of the outer volution they curve convexly and rather abruptly backward.

A few imperfect casts of the interior of shells of this species, some with small pieces of the test adhering to them, were collected by Mr. Dowling, in 1888, on the south-west shore of Dawson Bay, at two small points, one half a mile and the other three miles north of the mouth of Bell River. Similar specimens, some a little more perfect and others mere fragments, were obtained by Messrs. Tyrrell and Dowling, in 1889, at many localities in, on or near Lake Winnipegosis, as, at the south end of the lake, at an exposure two miles west of Meadow Portage, and on Charlie Island; on the south-west side, on a small island off Weston Point and on South Manitou Island; on the south-east side, at Point Brabant; and at the north-west end, in Cameron Bay .and at five exposures on the shores and islands of Dawson Bay; also on the Red Deer River, at and near the Upper Salt Spring.

The exact number of volutions in the shell of this species is unknown, as the upper part of the spire is broken off in the most perfect specimens collected. Of the two specimens figured, one (fig. 8) has a considerable portion of the test preserved on three contiguous volutions. The other (fig. 9) is a cast of the interior of a shell of this species, which has been slightly and abnormally compressed in such a way as to make the four or four and a half volutions preserved, appear unusually broad in proportion to their height. The actual height or length of this specimen is two inches and three-quarters, and it is probable that when entire its height slightly exceeded three inches.

The preceding description will no doubt have to be somewhat amended when more perfect specimens shall have been collected, but so far as can be ascertained at present, this species of *Loxonema* seems to differ from any of those from the Devonian rocks of North America, England or Europe that the writer can find described, in its laterally flattened volutions, crossed by densely disposed and nearly straight costulæ.

(S.) LOXONEMA PRISCUM, Munster. (Sp.)

Plate 44, fig. 2.

Melania prisca, Munster. 1840. Beitr., pt. 3, p. 83, pl. xv, fig. 1.

Holopella piligera, G. and F. Sandberger. 1853. Verstein. Rheinisch. Schichtensyst. Nassau, p. 228, pl. xxvi, figs. 9, 9a-c.

Loxonema deornatum, De Koninck. 1881. Ann. Mus. Royal, N. H. Belg., vol. VI, p. 47, pl. iv, figs 24 and 25.

Holopella piligera, Holzapfel. 1882. Palæontographica, vol. XXVIII, p. 249.

" Whidborne. 1889. Geol. Mag., dec. 3, vol. VI, p. 30.

Loxonema priscum, Whidborne. 1891. Mon. Devon. Fauna S. of England, vol. I, p. 181. pl, xvii, figs. 17-19.

A few specimens of a small *Loxonema*, which agree very well with the descriptions and figures of this species, were collected by J. W. Spencer in 1874 on the west shore of Dawson Bay ("from slabs apparently derived from the adjacent cliffs"); by J. B. Tyrrell and the writer in 1888 from rocks in or nearly in place at Monroe and Pentamerus Points, Lake Manitoba; and by Messrs. Tyrrell and Dowling in 1889, on or in Dawson Bay, at Whiteaves Point, at the mouth of Steep Rock River, and at the south end of Rowan Island.

Some of the specimens from these localities are extremely like the two Lummaton examples of *L. priscum* figured by the Rev. G. F. Whidborne (*op. cit.*), but the former are apparently a little the larger. The approximate dimensions of a large and nearly perfect specimen from Pentamerus Point are: height or length, twenty-eight mm.; greatest breadth, nine mm.: height of outer volution as measured in the median line of the dorsal surface, about nine mm. In some of the specimens from Lakes Manitoba and Winnipegosis the outer volution is more ventricose than that of the original of the figure on Plate xliv, and not so narrow at the base. The surface markings are not satisfactorily shown in any of them, but so far as can be ascertained, the shell is practically smooth to the naked eye, though a few obscure and minute lines of growth, parallel to the outer lip and close to it, can be seen with a lens on one specimen. In another, there is a single faint transverse constriction at a short distance from the aperture.

B. Slightly aberrant and reticulate species, whose surface is marked with spiral revolving raised lines or small ridges, as well as the usual sigmoidal costulæ or crowded growth lines.

(S.) LOXONEMA CINGULATUM. (N. Sp.)

Plate 44, fig. 3.

Shell rather large, narrowly elongated and many whorled: spire between three and four times as long as the outer volution. Volutions nine or ten, the apical ones being imperfectly preserved in the few specimens collected, compressed convex and increasing very slowly in size, those of the spire a little broader than high: outer volution moderately convex, as high as broad, narrowly rounded and somewhat produced at the base: axis imperforate: suture distinctly defined: aperture subovate, higher than wide and abruptly pointed above.

Surface marked with small and very narrow but prominent spiral ridges, which are regularly arranged and nearly equidistant, also by slightly flexuous and somewhat sigmoidal lines of growth. In the largest specimen collected, whose surface markings are not very well preserved, there appear to have been about seven spiral ridges on the dorsal surface of the last volution but two, nine on that of the last but one, and probably not less than ten and perhaps as many as eleven or twelve on that of the outer volution.

The figure on Plate xliv is taken from a wax impression of the dorsal surface of the last four volutions of an apparently adult specimen, with the earlier volutions restored from a gutta percha impression of another specimen in which these happen to be well preserved.

The maximum breadth of the outer volution of the largest specimen collected is twenty four millimetres, and the entire height or length of an adult specimen is estimated to have been about eighty five mm.

Lake Manitoba, at Point Richard, and Monroe Point, J. B. Tyrrell and J. F. Whiteaves, 1888: one specimen at each of these localities. Dawson Bay, Lake Winnepegosis, at Whiteaves Point (four specimens), on a small island about half way between that point and Salt Point (one specimen), and at the south end of Rowan Island (one specimen); J. B. Tyrrell and D. B. Dowling, 1889. All the specimens are mere natural moulds of the exterior of the shell, in dolomite, but in some the corresponding cast of the interior of the shell also is preserved.

The prominent spiral ridges of this shell, which resemble those of some of the recent and tropical Melanias from the Pacific or eastern hemisphere, will at once enable it to be distinguished from any other species of *Loxonema*.

LOXONEMA GRACILLIMUM. (N. Sp.)

Plate 45, fig. 10.

Shell very small, narrowly elongated, slender, turriculated and many whorled. Volutions about nine, increasing very slowly in size, the earlier ones of the spire moderately convex, the later ones ventricose in the middle and below (or anteriorly), but narrowly and concavely constricted next to the suture above, a little broader than high: outer volution apparently considerably higher but not very much broader than the one which immediately precedes it, though the basal portion and the characters of the aperture are unknown: suture distinctly defined.

Surface (of the lower volutions) marked with spiral revolving ridges, which are crossed by numerous and very minute sigmoidal costulæ, or simple and entire thread-like raised lines. In the only specimen collected, which is imperfect at the base, nine spiral or revolving ridges can be counted on the last volution, and six on the last but one. These ridges, most of which are large enough to be seen with the naked eye, are unequal in size, four of those on the most prominent and lower part of the two latest volutions being larger and more elevated than the others, and all of them are narrow and minutely tuberculated at the many points where the sigmoidal costulæ pass over them. The sigmoidal costulæ, which cross the volutions transversely and are parallel to the outer lip, have a slightly concave curvature above, or posteriorly, and an equally slight but convex curvature below. They are closely and very regularly disposed and so small as to be invisible without the aid of a lens.

Height or length of the only specimen collected, which, as already stated, is slightly imperfect anteriorly, nine millimetres and a half: maximum breadth of the outer volution of the same, about three mm.

Devils Point, Lake Winnipegosis, J. B. Tyrrell, 1889: a single but unusually well preserved mould of the exterior of the shell, in dolomite. The figure on Plate xlv is taken from a gutta percha impression of this mould, upon which the foregoing description also is based.

This species and the one previously described, although encircled by distinct spiral ridges, are also marked with the sigmoidal costulæ or growth lines parallel to the outer lip, which are so characteristic of *Loxonema*.

A fifth species of *Loxonema* is indicated by a single and nearly perfect cast of the interior of the shell, collected by Mr. Tyrrell, in 1889, at Roderick Point, Birch Island, Lake Winnipegosis. The outline and proportions of this specimen are quite unlike those of either of the four species already described or identified, but as its surface markings are entirely unknown, its specific relations cannot be ascertained.

(S.) MACROCHILINA SUBCOSTATA, Schlotheim. (Sp.)

Plate 44, figs. 4 and 5.

Buccinites subcostatus, Schlotheim. 1820. Petrefactenkunde, p. 130, pl. xii, fig. 3.

Buccinum imbricatum, Sowerby (pars). 1827. Min. Conch., vol. VI, p. 127, pl. dlxvi, fig. 2, right-hand figure only.

Macrocheilus arculatus, Phillips. 1841. Pal. Foss. Cornw., Dev., and W. Somers, p. 139, pl. lx, fig. 194.

Macrocheilus elongatus, Phillips. Ibid., p. 104, pl. xxxix, fig. 195.

Macrocheilus Schlotheimi, d'Archiac and de Verneuil. 1842. Trans. Geol. Soc. Lond., ser. 2, vol. VI, pt. 2, p. 354, pl. xxxii, fig. 2.

Loxonema Phillipsi, F. A. Roemer. 1843. Verst. Harz., p. 30, pl. viii, fig. 9.

Loxonema apressum, F. A. Roemer. Ibid., p. 30, pl. viii, fig. 10.

Buccinum arculatum, Goldfuss (pars). 1844. Petref. Germ., vol. III, p. 28, pl. clxxii, fig 15b only.

Macrocheilus subcostatus, Tschernyschew. 1887. Mem. Com. Geol. Russ., vol. III, No. 3, p. 171, pl. v, figs. 6a, b.

Macrochilina subcostata, Whidborne. 1891. Mem. Dev. Faun. S. England, vol. I, p. 159, pl. xvi, figs. 1-6.

Dawson Bay, Lake Winnipegosis, on a small island south-west of Whiteaves Point (one specimen), and on another about three miles north of Salt

Point (two specimens), also at two exposures, one about two miles west of Salt Point (two specimens), and the other at the mouth of the Red Deer River (where it appears to be abundant); J. B. Tyrrell, 1889.

Most of the specimens from these localities are either imperfect casts of the interior of the shell, with well preserved portions of the tests attached, or sharply defined moulds of the exterior, in dolomite. Only two or three testiferous specimens were obtained and these are very imperfect. The surface markings are very variable, not only in different specimens, but sometimes also in different parts of the same shell. Thus, on the outer volution of one of the specimens from the small island north of Salt Point, (fig. 5) the markings consist of slightly sigmoidal, acute ridges, from two to three millimetres apart, with fine striæ between them and parallel to them. On the other hand, in the original of fig. 4, which is drawn from a wax impression of a natural mould of a specimen from the mouth of the Red Deer River, the crowded subsigmoidal growth lines or minute costulæ are very nearly equal in size and not more than from one-half to a whole millimetre apart. In another specimen from the mouth of the Red Deer River the sigmoidal costulæ on the last whorl but one are nearly a millimetre apart, with finer striæ between them, but they suddenly become nearly equal in size and much closer together on the outer volution. The entire height of one of the largest specimens from Dawson Bay would probably have been about sixty millimetres.

It is still doubtful whether the distinction between *M. subcostata* and *M. arculata* can be sustained. The characters which Mr. Whidborne, the most recent writer on the subject, (op. cit., pp. 159-63) seems to rely upon for separating English or German examples of the two forms are, the proportionately narrower and shorter body whorl of *M. arculata*, its "flat, angulated shoulder," and finer and more irregular surface markings. Yet Mr. Whidborne includes in the synonymy of *M. arculata*, the specimen figured under the name *Macrocheilus arculatus* by Ferdinand Roemer, on Plate xxxii. (fig. 6) of the "Lethœa palæozoica," in which no such shoulder is apparent, and the Chudleigh specimens of *M. arculata*, which he himself figures, are all equally shoulderless. Fischer's figure of *Macrochilus arculatus*,* which is not referred to by Mr. Whidborne, is almost a facsimile of F. Roemer's, and the present writer has failed to understand how the specimens of *M. arculatus* figured by F. Roemer, Fischer, or Frech,† can be distinguished from the specimen of *M. subcostata* figured by d'Archiac and de Verneuil under the name *M. Schlotheimii*. Still, if these two names are to be retained, the Dawson Bay specimens undoubtedly agree better with the descriptions and figures of the shoulderless *M. subcostata* than with those of the strongly shouldered *M. arculata.*

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* Man. de Conchyliologie, &c., 1885, p. 698.

† Ueb. das Devon der Ostalpen, pt. 2, (Zeitschr. der Deutsch. geolog. Gesellsch., 1891) p. 679, pl. xliv, fig. 5.

(S.) MACROCHILINA PULCHELLA. (N. Sp.)

Plate 44, figs. 6 and 6a.

Shell small, the most perfect specimen collected being less than one-third the size of adult specimens of *M. arculata* from Dawson Bay, imperforate, but pointed above and one-third higher or longer than broad: spire almost conical, acutely pointed and a little shorter than the outer volution, as measured in the median line of the dorsal surface. Volutions five or six, those of the spire obliquely compressed, the outer one moderately convex, slightly inflated, but very faintly constricted above, about as broad or a little broader than high and narrowing abruptly into the evenly rounded base: suture impressed, linear and minutely crenulated by the transverse costulæ: aperture subovate, higher than wide and occupying more than one-half of the entire height, pointed above and rounded below: outer lip thin and simple.

Surface marked with closely and regularly arranged, flexuous raised lines, or nearly equidistant, extremely thin and acute, minute costulæ, which cross the volutions transversely but somewhat obliquely.

Dimensions of the specimen figured: height or length, eighteen millimetres and a half; maximum breadth, twelve mm.

South-west shore of Dawson Bay, about two miles west of Salt Point, J. B. Tyrrell, 1889: one nearly perfect specimen with the test preserved. Three casts of the interior of shells which are probably referable to this species, but which do not show a trace of the characteristic surface ornamentation, had previously been collected by Mr. Tyrrell and the writer, in 1888, at Pentamerus Point, Lake Manitoba. The largest of these casts is nearly an inch in length.

This delicately sculptured shell appears to differ from *M. arculata* chiefly in its diminutive size. It has somewhat the same general contour as the *Polyphemopsis Louisvillæ* of Hall and Whitfield,* from the Upper Helderberg limestone at the Falls of the Ohio, but that species is represented as narrow and somewhat pointed at the base, and its surface is stated to be smooth.

The following description should have followed that of *Pleurotomaria infranodosa,* on page 313.

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*Twenty-third Reg. Rep. N.Y. St. Cab. Nat. Hist., 1869, pl. xii, figs. 1 and 2; and twenty-fourth do., 1870, p. 193.

(S.) PLEUROTOMARIA SPENCERI. (N. Sp.)

Plates 41, figs. 4, 4a-b, 43, fig. 13, and 46, fig 1.

Shell depressed subturbinate, more than twice as broad as high, ovately orbicular as seen from above, spire low and short: base concavely depressed in the centre, but apparently not umbilicated in such a way as to expose any portion of the inner whorls. Volutions four, expanding rather gradually in a lateral direction, those of the spire depressed convex, the outer one occupying three-fifths of the entire diameter, somewhat flattened, both above and below, and depressed next to the suture above: periphery narrowly rounded: suture distinct. Aperture oblique, transversely elliptical, with the peristome interrupted on the columellar side, the interruption being caused by the encroachment of the narrow peripheral portion of the preceding volution: lip with a notch or slit obscurely indicated on the apical side of the periphery, but otherwise thin and simple, its inner margin shallowly concave.

Surface marked with numerous, closely and rather regularly disposed minute spiral ridges, which are crossed by still more minute lines of growth, parallel to the outer lip. These incremental striæ are too small to be seen without the aid of a lens, and are not shewn on any of the figures on Plates xli or xliii. They are, however, represented somewhat diagrammatically in fig. 1 on Plate xlvi. Slit band not clearly observed, though its presence is inferred, partly from the obscure notch or slit on the outer lip at the periphery and partly from the backward curvature of the lines of growth, both above and below.

Maximum breadth of the largest specimen collected, twenty-five millimetres: approximate height of the same, as measured in the median line of the dorsal surface, about ten mm.

Western shore of Dawson Bay, Lake Winnipegosis, "from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874: one specimen, the original of the figures on Plate xli. A few smaller and less perfect specimens, six in all, were collected by Messrs. Tyrrell and Dowling in 1889, in place, at exposures on two small islands in the southern part of Dawson Bay, and on the western shore of that bay, at the mouth of the Red Deer River and on the first small point north of the mouth of the Red Deer River. Small specimens, whose maximum diameter is about eight or nine millimetres, which are probably the young of this species, were collected by Mr. Tyrrell and the writer, in 1888, at Pentamerus Point, Lake Manitoba, and by Messrs. Tyrrell and Dowling in 1889, on three small islands in the southern portion of Dawson Bay. One of these specimens (from Pentamerus Point), is represented, twice the natural size, on Plate xliii, fig. 13. At this stage of growth the aperture of the shell is not far from circular in outline, and in one specimen the suture appears to have been somewhat channelled. Adult specimens have much the same shape as the recent *Stomatella imbricata* of Lamarck, but some which are not quite full grown have more the aspect of a *Sigaretus*.

This shell is very similar, both in shape and sculpture, to the *Pleurotomaria Sigaretus* of G. and F. Sandberger, but as the slit band and even the lines of growth of that species have never been seen, its generic position is quite uncertain. When that portion of this paper was published in which the species of *Pleurotomaria* are enumerated or described, (pp. 312–314) the writer was under the impression that the shell now under consideration should be referred to *Cyclonema* or *Polytropis.* Professor E. Koken (of Königsberg, Prussia), who has since examined the original of figs. 4, 4a and b, on Plate xli, is, however, of opinion that it is a true *Pleurotomaria*, and a careful re-examination of the minute growth lines of all the specimens has led the writer to form a similar conclusion. Professor Koken, in a letter to the writer, says that the whorls of *P. Sigaretus* are more rounded and more inflated than those of the present species, and the spire proportionately higher.

The writer has much pleasure in naming this shell in honour of its discoverer, Dr. J. W. Spencer, now State Geologist of Georgia.

PTEROPODA.

(S.) HYOLITHES ALATUS. (N. Sp.)

Plate 46, figs. 2, 3 and 4.

Shell large, attaining to a length of a little more than four inches, nearly straight, except when abnormally distorted, which it often is, narrowly elongated and increasing very slowly in thickness : sides broadly alate at their base, the " dorsal " margin being produced on each side into a broad thin laminar expansion. " Dorsal " side much flatter than the " ventral," slightly convex along the median line and broadly but shallowly concave on each side : ventral side strongly convex but angulated and obtusely subcarinate along the median line : outline of transverse section triangular, with the latero-basal angles produced on each side into a narrow projecting spur, the base of the triangle, with its two spurs, being more than twice as broad as the triangle is high, and each of its sides faintly convex. Shape of the aperture not clearly ascertainable, though on the dorsal side there is a broad and rather deep sinus, which is nearly flat at the bottom, in the middle of the lip, and a projecting lobe, which is broadly rounded on its inner margin and narrowly rounded or subangular externally, on each side, as represented by fig. 3.

The only surface markings that are preserved in any of the specimens are a few lines of growth on the dorsal side parallel to the outer lip. Operculum unknown.

Onion Point and Little Sandy Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888: Lake Winnipegosis, on the east shore at Point Brabant, and on the south-west shore of Dawson Bay, at two small points, one about half a mile and the other three miles north of the mouth of Bell River, D. B. Dowling, 1888: one or two specimens from each of these localities. A few specimens, also, were collected by Messrs. Tyrrell and Dowling, in 1889, at Lake Winnipegosis, on Snake and South Manitou islands, at Devils Point, in Cameron Bay, and at ten different exposures on the islands and shores of Dawson Bay; also, on the Red Deer River, half a mile above the Lower Salt Spring. The species appears to be rare in and below the Stringocephalus zone, and to be most abundant in the beds above that zone.

In the foregoing description the flattened side of the shell is regarded as the dorsal, and the strongly convex and angulated portion as the ventral, in accordance with the terminology used by Sowerby, Morris and Salter and by Walcott in his later publications.

Most of the specimens collected are either separate casts of the interior of the shell, or casts with the corresponding mould of the exterior, from which the intervening test has decayed. The outline of the transverse section of the shell, as represented by fig. 4, is well shown in many specimens. The test is rarely preserved, but indications of it are shown in three or four specimens, particularly in the original of fig. 3, which consists of the anterior moiety of a specimen, in which the central portion and one of the broad lateral wings of the dorsal surface are well exhibited, with the lines of growth and shape of the lip on that side.

Mr. Walcott says* that the *H. princeps*, Billings, "is the largest species of *Hyolithes* known," but some of the specimens of *H. alatus* collected by Messrs. Tyrrell and Dowling are considerably larger than any of Billings's types of *H. princeps* in the Museum of this Survey.

The present species is only referred to *Hyolithes* provisionally, as it seems to differ from that genus in its broad latero-basal alation, and more particularly in the deep central sinus of the lip on the dorsal side. It is most probable that a new genus will have to be constituted for its reception, but the specimens so far collected are too imperfect to admit of an accurate or sufficiently explicit generic description.

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*Bulletin U. S. Geological Survey, Washington, No. 30, 1886, p. 135.

CEPHALOPODA.

ORTHOCERAS HINDII.

Actinoceras Hindii, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 101, pl. vi, figs. 4a and 5.

Snake Island, Lake Winnipegosis, Prof. H. Youle Hind, 1858: one specimen. The species has since been collected by Messrs. Tyrrell and Dowling in 1889 at the following localities in, on or near Lake Winnipegosis. On Charlie and Snake Islands, at the southern extremity of the lake; on a small island off Weston Point; on South Manitou Island; at Point Brabant; on the south-west side of Cameron Bay; in Dawson Bay, on the second small point east of the mouth of Bell River; and on the Red Deer River, a mile above the Lower Salt Spring. A few specimens of a shell which appears to be an unusually slender variety of *O. Hindii*, were obtained by Mr. Tyrrell and the writer, in 1888, at Onion Point, Lake Manitoba.

Although slightly enlarged between the septa, the siphuncle of this shell is not nummuloidal as in *Actinoceras*, nor even distinctly moniliform as in *Sactoceras*. The characters of the species, therefore, seem to accord better with those of *Orthoceras* as described by most palæontologists (though perhaps not as restricted by Hyatt) than with those of *Actinoceras* or *Sactoceras*.

(S.) ORTHOCERAS (THORACOCERAS) TYRRELLII.

Orthoceras (*Thoracoceras*) *Tyrrellii*, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 100, pl. vii, figs. 1, 1a, 2, 3 and 4.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and the present writer, 1888: one specimen. Dawson Bay, Lake Winnipegosis, on the east shore, at Whiteaves Point (abundant), also on the west shore, near the mouth of Steep Rock River (two specimens), and at the mouth of the Red Deer River (a few characteristic fragments); J. B. Tyrrell, 1889.

GOMPHOCERAS MANITOBENSE.

Gomphoceras Manitobense, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 102, pl. vii, figs. 7 and 7a.

Lake Winnipegosis, at Snake Island and on a point a little to the south of Snake Island, on South Manitou Island, and on the south-west shore of Cameron Bay, also in or on Dawson Bay, at a small point three miles north of the mouth of Bell River, at Point Wilkins, and at the mouth of the

Red Deer River, J. B. Tyrrell and D. B. Dowling, 1889: a few specimens, some of them mere fragments, from each of these localities.

It is possible, as elsewhere stated (op. cit.) that this species may be a *Poterioceras* rather than a *Gomphoceras*.

(S.) CYRTOCERAS OCCIDENTALE.

Cyrtoceras occidentale, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 103, pl. vii, figs. 5, 5a, and 6.

Lake Winnipegosis, at Snake Island (one specimen), and around Dawson Bay, at Whiteaves Point (four specimens), at the mouth of Steep Rock River (pieces of the siphuncle only), and at the mouth of the Red Deer River (the largest specimen figured in the Trans. Royal Soc. Canada); J. B. Tyrrell and D. B. Dowling, 1889.

(S.) HOMALOCERAS PLANATUM.

Homaloceras planatum, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect 4, p. 105, pl. viii, figs. 1 and 2a-b.

Dawson Bay, Lake Winnipegosis, at Whiteaves Point, J. B. Tyrrell, 1889: one imperfect but characteristic specimen and three fragments.

In the elaboration of the generic and specific characters of this species and the next, the writer was materially assisted by Mr. L. M. Lambe.

(S.) TETRAGONOCERAS GRACILE.

Tetragonoceras gracile, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 105, pl. viii, figs. 2, 2a-b.

Western shore of Dawson Bay, Lake Winnipegosis, at an exposure about two miles west of Salt Point and four miles north-east of the mouth of Steep Rock River, J. B. Tyrrell, 1889: "one specimen imbedded in a piece of rock which has been so broken as to show nearly the whole of the characters of the interior of the septate portion of the shell, as well as the general shape of the latter."

(S.) GYROCERAS CANADENSE.

Gyroceras Canadense, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 106, pl. ix, figs. 1a-c, and 2.

Dawson Bay, Lake Winnipegosis, on a small island about half-way between Whiteaves and Salt Points, D. B. Dowling, 1888: one imperfect specimen. Dawson Bay, at Whiteaves Point (five specimens), and at a point three miles north of the mouth of Bell River (one specimen); J. B. Tyrrell, 1889.

(S.) GYROCERAS FILICINCTUM.

Gyroceras filicinctum, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 107, pl. ix, fig. 3.

Pentamerus Point, Lake Manitoba, J. B. Tyrrell and J. F. Whiteaves, 1888 : one fragment. Dawson Bay, Lake Winnipegosis, at the mouth of the Red Deer River (three specimens), and the first small point north of the mouth of that river (one specimen) ; J. B. Tyrrell and D. B. Dowling, 1889.

GYROCERAS SUBMAMILLATUM.

Gyroceras submamillatum, Whiteaves. 1891. Trans. Royal Soc. Canada, vol. VIII, Sect. 4, p. 107, pl. x, figs. 1 and 1a.

Snake Island, Lake Winnipegosis, Professor H. Y. Hind, 1858 : the specimen referred to by E. Billings on page 187 of Hind's Report of the Assiniboine and Saskatchewan Exploring Expedition as "a species of *Nautilus* or *Gyroceras*." Steep Rock Point, Lake Manitoba, J. B. Tyrrell, 1888 : one imperfect specimen. Lake Winnipegosis, at the north end of Snake Island (a large fragment), on South Manitou Island (two specimens), and on a small island off Weston Point (one specimen) ; also at Swan Lake, Manitoba, near the mouth of the Swan River (one specimen) : J. B. Tyrrell, 1889.

CRUSTACEA.

OSTRACODA.

ISOCHILINA DAWSONI, Jones.

Isochilina Dawsoni, Jones. 1891. Contr. to Canad. Micro-Palæont., vol. I, pt. 3, p. 93, woodcuts 7a, b, c.

South-east side of Dawson Bay, Lake Winnipegosis, on a small island north of Whiteaves Point, J. B. Tyrrell, 1889 : a few casts of the interior of separate valves.

ELPE TYRRELLII, Jones.

Elpe Tyrrellii, Jones. 1891. Contr. to Canad. Micro-Palæont., vol. I, pt. 3, p. 93, woodcuts 2 a, b, c, (a misprint for 8 a, b, c).*

Same locality, collector and date as for the preceding species : one cast of the interior of both valves.

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*By an unfortunate mistake the figures are numbered 2a, 2b, 2c, but the explanations immediately below them are correctly stated to be those of figs. 8a, b, c.

LEPERDITIA (?) EXIGUA, Jones.

Leperditia (?) exigua, Jones. 1891. Contr. to Canad. Micro-Palæont., vol. I., pt. 3, p. 94, pl. xii., fig. 10.

East side of Lake Winnipegosis, on a small island east of the south end of Birch Island, about four miles north-east of Wade Point, thirty miles south of Long Point, J. B. Tyrrell, 1889 : a single left valve.

TRILOBITA.

(S.) BRONTEUS MANITOBENSIS. (N. Sp.)

Plate 46, figs. 5, 6 and 7.

This singular species is based upon very imperfect specimens of the head of five different individuals, but as it is not quite certain that they all belong to the same species, it is thought best to describe each specimen separately.

Specimen No. 1 (fig. 5), consists of the median portion of the head of an unusually small individual, of which little more is preserved than the glabella, with its long posterior median spine, and the postero-lateral spine on each of the fixed cheeks. This specimen was collected by Mr. Tyrrell, in 1889, on a small island north of Whiteaves Point, Dawson Bay, Lake Winnipegosis, and may be characterized as follows. Glabella moderately convex, inversely subconical in outline, broadest anteriorly and narrowing gradually backward, shallowly sinuated at its margin on each side by the second or median pair of lateral glabellar depressions, then slightly expanded posteriorly and ultimately faintly constricted and narrowing rather abruptly into a nearly straight and very slender, median and posterior, tubular spine, which is fully twice as long as the non-spinose portion of the head, if not more, and directed backward. Although three pairs of glabellar furrows are obscurely indicated in specimens Nos. 3, 4 and 5, by as many short lateral depressions or pits, only the anterior and median pair can be detected in this specimen and the next. On each side of the glabella, but just outside of it and commencing much farther forward than the median posterior spine, there is a rather shorter, stouter and more curved postero-lateral spine, which is nearly parallel with the median spine, and, like it, directed backward. The surface, which is rather worn, is marked indistinctly with minute scattered tubercles, which are too small to be seen without the aid of a lens.

This is the only specimen in which the long and slender postero-median and postero-lateral spines are preserved.

Specimen No. 2, which not figured, was collected by Mr. Tyrrell or the present writer, in 1888, at Monroe Point, Lake Manitoba. It is a portion of a glabella of a rather larger individual than the last, with a very short piece of the postero-median spine preserved. It is very imperfect anteriorly and shows only two pairs of the lateral glabellar depressions. The tuberculation of the surface, however, is much more clearly shown in it than in specimen No. 1.

Specimens Nos. 3 and 4. These are two examples, one of which is figured (fig. 6), of the central portion of the head of still larger individuals than Nos. 1 and 2, collected by Mr. Tyrrell and the present writer, in 1888, at Pentamerus Point, Lake Manitoba. Both are nearly perfect anteriorly, but imperfect posteriorly. They show that the front margin of the head is nearly straight, or but slightly convex in the centre, and that it is bordered by a narrow raised rim, which is succeeded by a transverse linear depression or faint groove. On the glabella of both there are three pairs of short lateral depressions or pits. The postero-median spine of each is broken off and scarcely a vestige remains in either of the two postero-lateral spines. The tuberculation of the surface is well preserved in both, and in one of these specimens there is a low conical tubercle, much larger than any of the others, nearly in the centre of the glabella.

Specimen No. 5 (fig. 7). This is a fragment of the anterior portion of the head of an individual of much larger size even than Nos. 3 and 4, collected by Mr. Dowling, 1889, on the west side of Dawson Bay, at the south end of Rowan Island. The anterior and median lateral depressions of the glabella are well shown on the right side of this specimen, and the posterior lateral depression on the left. The surface of these depressions is nearly smooth and the more or less scattered tubercles upon the remainder of the test are very irregular in their distribution. When examined with a lens, the anterior portion of the glabella shows traces of raised lines running parallel to the front margin of the head.

The position of the eye is not indicated in any of these specimens, and not a vestige of the free cheeks is preserved. Still, the few fragmentary examples so far obtained seem to indicate a hitherto undescribed species of *Bronteus*, in which the postero-median spine of the glabella and the pair of postero-lateral spines on the fixed cheeks, are far longer and more slender than the corresponding spines on the head of the *B. rhinoceros* of Barrande.* Apart from the circumstance that they both bear three spines on the posterior portion of the head and, possibly another in the centre of the glabella, there is indeed very little resemblance between this species and *B. rhinoceros*, the shape and surface ornamentation of the glabella and the modifications of the glabellar furrows in these two forms being quite different. The surface markings of the head of the present species are more like those of the *B. granulatus* of Goldfuss, as described and figured by European and English writers.

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*Sil. Syst. du Centre de la Bohême, vol. I, Suppl., 1872, p. 131, pl. ix, figs. 12-19.

(S.) LICHAS (TERATASPIS). N. Sp.

Plate 46, fig. 8.

Portions of the marginal spines of the pygidium of a trilobite apparently congeneric with the *Terataspis grandis* of Hall, were collected by Mr. Dowling, in 1889, on the west side of Dawson Bay, Lake Winnipegosis, at the south end of Rowan Island. These specimens, which are figured, probably represent an undescribed species of *Terataspis*, which cannot yet be properly characterized for want of sufficient material. The species indicated, however, was clearly of much smaller size than *T. grandis*, and the spinules on the spines of the pygidium of the former are feeble and ramose, not stout and simple like those on the tail spines of *T. grandis*.

(S.) CYPHASPIS BELLULA. (N. Sp.)

Plate 46, figs. 9 and 9a.

Head strongly convex and distinctly three-lobed, much broader than long, rounded in front, nearly straight at the sides, but slightly constricted posteriorly: genal angles produced backward into a pair of slender and nearly parallel or but slightly divergent spines, which are nearly as long as the unarmed portion of the cephalic shield, as measured along the median line. Border prominent but rather narrow, although thickened by doublure, the test being very thin: marginal sulcus rather broad but shallow. Facial suture intersecting the occipital sulcus just inside the genal angle, passing obliquely and rather abruptly inward and forward to the eye-lobe, thence rather more gradually outward and forward to the anterior margin. Glabella occupying about one-third of the length of the cephalic shield, as measured in the median line, convex, prominent, egg-shaped, longer than broad, broadest anteriorly and surrounded by a groove, the basal portion of which is formed by the occipital sulcus: latero-basal lobes small, moderately prominent, egg-shaped, a little longer than broad and broadest behind. Eye-lobes more prominent than the latero-basal lobes, their visual surface not preserved. Cheeks strongly convex round each eye-lobe and sloping abruptly downward to the lateral margin. Thorax and pygidium unknown.

Surface ornamented with numerous and rather closely disposed but distinct, minute rounded tubercles, which are obsolete upon the anterior marginal and occipital sulci, as well as upon the genal spines. The occipital ring also is smooth, with the exception of a single circular tubercle in the centre. Most of the projecting part of the outer border is broken off in the few specimens collected, and even when otherwise uninjured its surface markings are very badly preserved, though they seem to have consisted of a single row of tubercles.

Dimensions of the most perfect specimen collected : maximum breadth of head, 8·25 mm. ; length of the same, as measured in the median line, 6·25 mm.; length of glabella of the same, 4·25 mm.

Lake Winnipegosis, on three small islands in the southern portion of Dawson Bay, J. B. Tyrrell, 1889 : four specimens from one of these islands and one from each of the others. The specimens consist of nearly perfect and fairly well preserved detached heads, with the free cheeks in place, but the summits of the eye-lobes of each specimen are broken off, as are also the slender genal spines, with one exception, and the surface ornamentation of the anterior border is very obscurely indicated.

This little trilobite seems to have much the same kind of surface markings as the *C. ornata* of Hall* (from the Hamilton formation of the State of New York) though the anterior border of the former may prove to be spinose, when better preserved specimens shall have been collected. The glabella and fixed cheeks of *C. ornata*, however, are represented as being very much less convex than those of the present species.

(S.) PROETUS MUNDULUS. (N. Sp.)

Plate 46, figs. 10 and 11.

General form narrowly subelliptical, the length, as measured along the median line, being about twice the maximum breadth : surface depressed convex, but distinctly trilobate, with a prominent axis.

Head nearly semicircular in outline, much broader than long, rounded in front and broadest at the base : characters of the genal angles, and those of the genal spines, if there were any, unknown. Frontal area rather broad and flattened, margined externally by a very narrow but rather prominent upturned rim. Facial suture normal, intersecting the anterior margin almost in a line with the most prominent lateral portion of each eye. Glabella (fig. 11) moderately convex, distinctly defined and bounded on all sides by a narrow groove, a little longer than broad and broadest posteriorly, ovately subtriangular in outline, but with the anterior angle more broadly rounded than the postero-basal angles, and the sides very faintly constricted at the second pair of glabellar furrows, and nearly opposite the anterior termination of each eye. Glabellar furrows in three pairs, each lateral and oblique: the first pair straight and very short, the second curved and longer than the first, the third longer than the second and curving obliquely into the occipital furrow on each side, thus separating a pair of lateral lobes at the base of the glabella. Occipital lobes represented by a pair of small, distant tubercles in the occipital furrow, one placed close to and immediately behind the postero-basal angle of each of the latero-basal lobes of the glabella: occipital furrow narrow: occipital ring rather broad and flat. Cheeks moderately prominent around the eye-lobe, sloping rather abruptly downward and outward: eyes prominent, appressed close to the sides of the glabella, and placed much nearer to the occipital furrow than to the anterior or lateral margins of the cephalic shield.

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*Palæont. St. N. York, vol. VII, 1888, p. 145, plates xxi, fig. 1, and xxiv, fig. 21.

Thoracic segments, apparently nine in number, those of the axis prominent and strongly convex, the pleuræ not quite so convex.

Pygidium rather more narrowly rounded at its outer margin than the cephalic shield, its border narrow and flat: axis composed of from about eleven to thirteen segments: pleuræ about nine.

Glabella and fixed cheeks minutely tuberculated, the flat frontal area smooth. Surface markings of thorax and pygidium unknown, as the test is not preserved upon either, in any of the specimens collected. Under a lens, however, well preserved casts of the pygidium show that its axis and pleuræ are also minutely tuberculated, and that there is a comparatively large pair of tubercles on each annulation of the axis, one on each side of its outer boundary.

Approximate length of the most perfect specimen collected, as measured in the median line, twenty-one millimetres; greatest breadth of the thorax of the same, ten millimetres.

"Western Shore of Dawson Bay," Lake Winnipegosis, "from slabs apparently derived from the neighbouring cliffs," J. W. Spencer, 1874: one cast of the head, minus the free cheeks, and casts of two pygidia. Several additional specimens of this trilobite were collected by Mr. Dowling in 1888, and by Mr. Tyrrell in 1889, in the Stringocephalus zone at three small islands in the southern portion of Dawson Bay, and at an exposure on the south-western shore of that bay, about two miles west of Salt Point. These specimens consist of a few detached heads, with the free cheeks in place, some with most of the test preserved; numerous sharply defined casts of the pygdium ; one cast of the dorsal surface of the united head (minus the free cheeks), thorax and pygidium; an united head and thorax, and a cast of the thorax and pygidium.

At the time that the introduction to this paper was written, the writer was under the impression that the three specimens of the trilobite now under consideration, collected by Dr. Spencer, represented "a variety of *Proetus Haldemani*," as stated on page 257 (lines 17 and 18 from the top). A subsequent study of the whole of the specimens collected, however, has led to the conclusion that they indicate a previously undescribed and probably distinct species of *Proetus*, which is more nearly related to the *P. Rowi*, Green (Sp.), *P. Prouti*, Shumard, and *P. curvimarginatus*, Hall, as described and figured in the seventh volume of the Palæontology of the State of New York, than to *P. Haldemani*. The characters by which these three most nearly related species of *Proetus* can most readily be distinguished from *P. mundulus*, are as follows. The anterior margin of the cephalic shield of *P. Rowi* is not narrowly upturned, its eyes are apparently larger proportionately than those of *P. mundulus*, and there are only from nine to ten annulations in the axis of the pygidium of *P. Rowi*, and from six to seven pleuræ. *P. Prouti* has an upturned border to the anterior margin of the head, but it is said to have four pairs of lateral furrows on the glabella, eight to ten annulations on the pygidium and six to eight pleuræ. *P. curvimarginatus* is described as having four pairs of lateral glabellar furrows, large occipital lobes, and a pygidium with thirteen to fourteen annulations on the axis and twelve pleuræ.

Two fragmentary specimens of a small trilobite which may be referable to *P. mundulus*, were collected by Mr. Tyrrell in 1889, at Devils' Point, Lake Winnipegosis, from beds whose stratigraphical position is immediately below the Stringocephalus zone. These specimens are mere casts of the under surface of the right free cheek of two individuals.

A few specimens, which are also probably referable to *P. mundulus*, were collected by Mr. Tyrrell, in 1889, from beds whose stratigraphical position is above the Stringocephalus zone, on the south-western shores of Pelican and Cameron bays, Lake Winnipegosis; in Dawson Bay, at the first small point north of the mouth of Bell River; and on the Red Deer River, at the Upper Salt Spring. Most of the specimens from these localities are separate pygidia, with the test preserved. Some of these pygidia are much larger and more narrowly rounded posteriorly than those of the typical form of *P. mundulus* from the Stringocephalus zone, and, in the largest of these large pygidia there appear to be about thirteen or fourteen annulations on the axis and perhaps as many as eleven pleuræ. The surface of these testiferous pygidia, also, when examined with a lens, is seen to be faintly and very minutely tuberculated. One of the specimens from Cameron Bay is a detached left free cheek with the test preserved, but its lower surface only is exposed, the upper being buried in the matrix. In this specimen only the rather broad basal portion of the genal spine is preserved.

FISHES.

HOLOCEPHALI.

CHIMÆROIDEI.

PTYCTODUS CALCEOLUS, Newberry and Worthen.

Rinodus calceolus, Newberry and Worthen. 1866. Pal. Illinois, vol. II, p. 106, pl. x, figs. 10, 10 a–c.

Ptyctodus calceolus, Newberry. 1875. Rep. Geol. Surv. Ohio, vol. II, pt. 2, (Palæont.) p. 59, pl. lix, fig. 13.

Lake Winnipegosis, on a small island at the southern extremity of the lake (one tooth), on the western shore of Dawson Bay, at Point Wilkins (three separate teeth), and at the head of a small bay about three miles south of that point (one tooth); J. B. Tyrrell, 1889. Two small teeth, which are possibly referable to this species, were obtained by Mr. Tyrrell, in 1889, at an exposure on the Red Deer River, about a mile above the Lower Salt Spring.

Separate teeth of *P. calceolus* are not uncommon in the Hamilton Formation of Western Ontario, on the banks of the Sable River, at Bartlett's Mills, near Arkona, and elsewhere.

RHYNCHODUS. (Sp. Undt.)

An imperfect tooth, apparently from the lower jaw, of a species of *Rhynchodus*, was collected by Professor H. Youle Hind, in 1858, at the north end of Manitoba Island. The specimen is still preserved in the museum of the Survey.

DIPNOI.

ARTHRODIRA.

DINICHTHYS CANADENSIS. (N. Sp.)

Plate 46, fig. 12.

"Premaxillary" tooth or dental plate (the only part of the fish yet collected) of small size for the genus, its upper portion laterally expanded and subrhombic in outline, its lower portion abruptly contracted on one side and produced into a large, narrow, conical and pointed process which projects downward and constitutes a lateral cone of the crown. Upper and expanded portion of the tooth convex externally and concave internally: the angle formed by its upper and outer sides much more acute than those formed by the upper and inner and outer and lower, that formed by the upper and inner side being not only obtuse but rounded off. Lower and conical portion of the tooth prominent, angulated and obtusely subcarinate along the median line above (the obtuse keel extending backward to, or rather rising abruptly in and commencing at the centre of the upper and expanded portion), and flattened below, the outline of its transverse section being distinctly triangular.

Surface nearly smooth, though a slightly roughened subtriangular area, devoid of enamel, and probably representing the "root" of the tooth, is bounded by the upper and outer sides of the expanded portion and by a line which might be drawn from the outer lateral margin a little above the angle formed by the lower and outer sides, to the rounded off angle at the junction of the upper and inner sides, and passing just above the abrupt commencement of the blunt keel which ultimately runs down the median line of the cone of the crown.

Snake Island, Lake Winnipegosis, D. B. Dowling, 1889 : the specimen figured.

This detached tooth or dental plate is apparently homologous with one of the large dental plates, which Dr. Newberry provisionally termed the "premaxillaries," in the centre of the upper jaw of *Dinichthys.* It is doubtful, however, whether it represents the so-called "premaxillary" of the right side, or that of the left. In the preceding description, it has been regarded as the "premaxillary" of the right side, because, in the corresponding dental plate of *D. Terrelli and D. Hertzeri*, as represented diagrammatically by Dr. Newberry*, it is the outer side of the upper portion that is laterally expanded. If the specimen from Snake Island should prove to be the "premaxillary" of the left side, the terms inner and outer, in the preceding description of its characters, will of course have to be reversed. In either event, it is not at all likely to be confounded with the "premaxillary" of any of the described species of *Dinichthys.*

ASPIDICHTHYS (?) NOTABILIS. (N. Sp.)

Plate 47, figs. 1 and 1a.

The foregoing name is suggested provisionally for a specimen, which, as suggested to the writer by Professor Cope, is probably the median plate of the ventral shield of a large fish belonging to the family *Coccosteidæ.* When entire, this plate must have been eight inches or more in length and at least seven inches in its maximum breadth. The specimen, which was collected by Mr. Tyrrell, in 1889, at South Manitou Island, Lake Winnipegosis, is very well preserved, although imperfect and somewhat crushed or distorted. It is nearly flat but slightly convex above, and shallowly concave below. As viewed from above, it consists of a central tuberculated area, with a broad and slightly bevelled outer margin devoid of tubercles. The central tuberculated area, whose outer limits are by no means sharply defined, is longer than broad, symmetrical, and somewhat five sided, though the side which presumably represents the anterior end of the plate and which therefore it will be convenient to call the antero-median side, is shorter and narrower than any of the others, and concavely and rather deeply emarginate, apparently to allow of the overlap of the narrowly rounded posterior end of an antero-median plate. The two antero-lateral sides are at first nearly straight and parallel to the longitudinal axis of the plate, but they are very slightly expanded about the midlength and concavely contracted posteriorly. The two postero-lateral sides are nearly straight and converge gradually and obliquely until they meet at an acute angle in the centre posteriorly. The outer and non-tuberculate margin is nearly two inches in breadth at its broadest part.

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*Rep. Geol. Surv. Ohio, vol. II, pt. 2, Palæont., (1875), pp. 7 and 8.

The surface markings of the central area consist of numerous small, smooth and rounded tubercles, which are unequal in size and irregular in their distribution, though the largest average two millimetres in diameter at the base, and from two to five millimetres in their distance apart at the summits. The greater part of the bevelled outer margin is smooth to the naked eye, but around its outer limits there are indications of short and irregular radiating grooves and ridges.

The actual length of the central tuberculated portion of the specimen, as measured in the median line, is 167 millimetres: the approximate breadth of the same, at the lateral angles, is about 113 mm. The maximum thickness of the test is six mm.

The genus *Aspidichthys*, Newberry, was based upon a single dorso-median plate, of gigantic dimensions, which is stated * to be "similar in form to that of *Pterichthys*, but many times larger" and to be "covered with large hemispherical, smooth, enamelled tubercles." "The most striking feature in this plate," Dr. Newberry says,† "is its external ornamentation. This consists of knobs or bosses of smooth, shining enamel, of the size and form of split peas. In its general aspect this tuberculation resembles that of *Pterichthys* or *Coccosteus*, but differs strikingly in this, that the tubercles are perfectly smooth and polished, and show nothing of the stellate ornamentation which is to be seen on the plates of nearly all the great mailed fishes of the old world." This character, Dr. Newberry thinks, is of generic value.

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* Rep. Geol. Surv. Ohio, vol. I, pt. 2, Palæont., (1873), p. 322.

† Ibid., p. 323.

The ventral armature of *Aspidichthys clavatus*, Newberry, the typical and heretofore only known species of the genus, is entirely unknown, and the imperfect median ventral plate collected by Mr. Tyrrell is referred to *Aspidichthys* provisionally, only on account of the similarity of its surface ornamentation to that of the dorso-median plate of *A. clavatus*. The impression that the specimen from South Manitou Island makes upon the mind of the writer is that of the median ventral plate of a large fish more nearly allied to *Coccosteus* than to *Pterichthys* or *Bothriolepis*, but which differs from that of *Coccosteus* in the circumstance that it is partially overlapped, not only by the two postero-lateral and two antero-lateral plates, but also by the narrowly rounded end of an antero-median plate. The median ventral plate of *A. notabilis* was evidently of much smaller size than that of *A. clavatus* could have been, besides being much more minutely tuberculated, and it is quite likely that the discovery of more perfect specimens of these two forms may show differences between them that are of generic rather than of specific value.

TELEOSTOMI.

CROSSOPTERYGII.

ONYCHODUS. (Sp. Undt.)

An imperfect scale of a fish, which is probably referable to this genus, was collected by Mr. Tyrrell or the present writer, in 1888, on the north shore of Manitoba Island, in Lake Manitoba. The scale is not quite three-quarters of an inch in its maximum diameter, cycloidal and not far from circular in outline. Its under surface, the surface which happens to be exposed, is marked by fine concentric wrinkles and by very minute radiating raised lines, which are too small to be seen without the aid of a lens. The substance of the scale is so thin as to be transparent, and with a lens minute tubercles, apparently for the most part disposed in radiating lines, can be detected over most of its upper surface.

All the remains of fishes that have so far been collected from the Devonian rocks of this region, are from the beds immediately above the Stringocephalus zone, at the supposed base of the Upper Devonian.

The stratigraphical relations of the subdivisions of the Devonian system in this region are described in detail in Mr. Tyrrell's "Report on North-western Manitoba, with portions of the adjacent districts of Assiniboia and Saskatchewan," published as Part E of vol. V, New Series, of the Annual Reports of this Survey. In a preceding paper, published in the Transactions of the Royal Society of Canada for 1891,* Mr. Tyrrell states that "near the north-eastern angle of Lake Manitoba the typical Niagara dolomites are overlain by a few feet of thick-bedded stromatoporoid magnesian limestone holding *Pycnostylus Guelphensis*," which probably represents the Guelph formation. "Over these Silurian limestones there is, in the lacustral region, a gap in the known section," and the lowest Devonian rocks exposed are a few feet of soft red shales, which are apparently unfossiliferous. Above these shales, "a hundred feet or more of harsh porous dolomites, containing *Pentamerus comis*, &c.," are "overlain by a similar thickness of tough white dolomites containing *Stringocephalus Burtini*." Above these dolomites are fifty to seventy feet of calcareous shales marked by many brine springs along their line of outcrop;" to these succeed a "highly fossiliferous limestone containing great beds of *Atrypa reticularis*, and this is "overlain by light grey compact brittle limestones which represent the local top of the Devonian." "As far as could be seen," the whole of these rocks "are practically conformable and almost undisturbed throughout."

It has already been stated (on page 258) that all the fossils that are enumerated or described in the present paper, are probably from the Middle and Upper Devonian. The Middle Devonian appears to be represented in this region by the Stringocephalus zone and the hundred feet or more of fossiliferous dolomite immediately beneath it, and the Upper Devonian by all the beds above the Stringocephalus zone and beneath the Cretaceous.

The discovery of dolomites in which *Stringocephalus Burtini* is one of the most characteristic fossils, at many localities on the shores or islands of Lakes Manitoba and Winnipegosis, is of considerable interest to the geologist. In Manitoba the Stringocephalus zone appears to occupy much the same stratigraphical position as the Stringocephalus limestone of Germany and England, and it is noticeable that among the fossils of the Stringocephalus zone of Manitoba there are several which can be identified with well-known European species. Among these are *Sphærospongia tessellata*; *Favosites Gothlandica*; *Pachypora cervicornis*;

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*Vol. IX, Sect. 4, pp. 91, 92.

Productella productoides, var. *membranacea* : *Strophodonta interstrialis* ; *Atrypa reticularis*, and its var. *aspera* ; *Rhynchonella pugnus* ; *Paracyclas antiqua* ; the *Murchisonia* referred to on p. 315 as *M. Archiacana*, but which, as stated in a postscript a little farther on, is probably a variety of the *M. turbinata* of Schlotheim ; *Euomphalus annulatus* ; *Loxonema priscum* ; and *Macrochilina subcostata* ; besides the *Stringocephalus Burtini* itself.

In the preceding pages a (S.) is prefixed only to those species which are characteristic of beds in which Stringocephalus has actually been found. It has been omitted in some few instances, such as in the case of *Cyrtina Hamiltonensis*, for example, where the species seems to be rare in the Stringocephalus zone, but abundant in the beds below or above that zone ; and it is of course not prefixed to species from beds whose lithological characters and stratigraphical position are believed to be identical with those of the Stringocephalus zone, although no specimens of Stringocephalus have as yet been found in them.

The "Cuboides zone" appears to be represented in this region by those beds on the Red Deer River and elsewhere, in which *Cyathophyllum vermiculare*, var. *præcursor* ; *Cyathophyllum dianthus* ; *Chonetes Logani*, var. *Aurora* ; *Productella subaculeata* ; *Orthis striatula* ; *Strophodonta arcuata* ; and *Cyrtina Hamiltonensis* are the prevalent fossils, although *Rhynchonella cuboides* itself has not yet been found in them.

POSTSCRIPT.

MURCHISONIA TURBINATA, Schlotheim. Var.

Murchisonia angulata, var. A. d'Archiac and de Verneuil. 1842. Trans. Geol. Soc. Lond., Ser. 2, vol. VI., p. 356, pl. xxxii, fig. 7.

Murchisonia Archiacana, Whiteaves. 1892. This vol., p. 315, pls. xli, fig 7, and xlv, fig. 3. Not *M. Archiacana*, de Koninck.

Murchisonia turbinata, Schlotheim, var. Whidborne. 1892. Mon. Dev. Fauna S. England, vol. I, p. 307, pl. xxx, figs. 5-10.

Since pages 315 and 316 of this paper were printed, Professor Koken has reminded the writer that the name *Murchisonia Archiacana* is preoccupied by de Koninck, but in the concluding part of the first volume of his Monograph on the fossils of the Devonian Rocks of the South of England, just received, Mr. Whidborne regards both forms of the *M. angulata* of d'Archiac and de Verneuil, as mere varieties of *M. turbinata*, Schlotheim.

ERRATA

Page 257. Lines 15 and 16 from the top, for "the 'Euomphalus' is a small species of *Straparollus* here described and figured as *S. filicinctus*;" read "the *Euomphalus* is *E. annulatus*, Phillips."

Page 257. Lines 17 and 18 from the top, for "the *Phillipsia* a variety of *Proetus Haldemani*"; read "the *Phillipsia*, an apparently new species of *Proetus*, which is described in this paper under the name *P. mundulus*."

Page 291. Line 5 from the top, for "1890" read "1891."

Page 295. Line 8 from the bottom, erase the words "(Separate copies)," and on the line above, for "1890" read "1891."

Page 300. Lines 13 and 14 from the bottom, for "in the Upper Devonian," read "at the base of the Middle Devonian."

Page 302. Line 20 from the top, for "1890" read "1891," and on the line below erase the words "(Separate copies)."

Page 311. Line 3 from the top, for "1890" read "1891," and on the line below erase the words "(Separate copies)."

Page 312. Line 9 from the bottom, erase the words "(Separate copies)," and in the line above, for "1890" read "1891."

Page 315. Line 13 from the top, for "*Murchisonia Archiacana* (Nom. Nov.)" read "*Murchisonia turbinata*, Schlotheim. Var."

GEOLOGICAL SURVEY OF CANADA
GEORGE M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY

PART V., and Last

7. On some additional or imperfectly understood fossils from the Hamilton formation of Ontario, with a revised list of the species therefrom

(WITH GENERAL TITLE PAGE, LETTER OF TRANSMITTAL, APPENDIX AND INDEX)

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BY J. F. WHITEAVES.

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that he collected fossils at Thedford (Widder) and the neighbourhood for the seven consecutive years from 1872 to 1879, both years inclusive.

Since this paper was written, the publication of several monographs on special groups of fossils has thrown new light upon this local fossil fauna, and much additional material has been accumulated by local collectors. During three visits to Thedford, in 1889, 1891 and 1897, the writer has not only collected the fossils of that neighbourhood (inclusive of Bartlett's Mills) but also made careful examinations of the collections made by the Rev. Hector Currie, and more recently by Mr. G. Kernahan and Mr. N. J. Kearney, of Thedford. These gentlemen have kindly lent to the writer most of the choicest specimens that they have obtained up to the present

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7. *On some additional or imperfectly understood fossils from the Hamilton formation of Ontario, with a revised list of the species therefrom.*

The second paper in this volume, on the fossils of the Hamilton formation of Ontario, was based upon all the specimens that the writer had seen, and upon all the information on the subject that was available up to the close of 1886. In that paper, the names of the earliest collectors of the fossils of these rocks and the dates at which the collections were made, were inadvertently omitted. All the authentic information on these points that the writer has been able to gather, is as follows:—

1855. Alexander Murray and James Hall collected fossils together at Widder and along the Rivière aux Sables at Bartlett's Mills, and elsewhere, in 1855, as stated in Murray's Report for that year and verbally by Professor Hall to the writer in the spring of 1890.

1868. Numerous fossils in the Museum of the Survey are labelled "Hamilton formation, Bosanquet, J. Pettit, 1868."

1873–74. Professor H. A. Nicholson (in a letter dated March 7, 1898) says that his collecting near Widder and Arkona was carried on principally, if not entirely, during the years 1873 and 1874.

1872–79. Dr. G. J. Hinde (in a letter dated February 5, 1898) says that he collected fossils at Thedford (Widder) and the neighbourhood for the seven consecutive years from 1872 to 1879, both years inclusive.

Since this paper was written, the publication of several monographs on special groups of fossils has thrown new light upon this local fossil fauna, and much additional material has been accumulated by local collectors. During three visits to Thedford, in 1889, 1891 and 1897, the writer has not only collected the fossils of that neighbourhood (inclusive of Bartlett's Mills) but also made careful examinations of the collections made by the Rev. Hector Currie, and more recently by Mr. G. Kernahan and Mr. N. J. Kearney, of Thedford. These gentlemen have kindly lent to the writer most of the choicest specimens that they have obtained up to the present date and have presented many of them to the Museum of the Survey. Mr. Charles Schuchert, who made an unusually large collection of the fossils of the Thedford district in 1895 for the United States National Museum, has favoured the writer with a most accurate list of all the species that he obtained on this occasion, and generously supplemented it with a loan of specimens of forty-five of the species, for examination and comparison. Exclusive of some undetermined and possibly undescribed polyzoa (bryozoa), Mr. Schuchert's list, which, with his permission, has been freely used in the preparation of this paper, includes the names of about thirty species that had not previously been found in this formation in Canada. Mr. B. E. Walker, of Toronto, who made a collection of the fossils of the Thedford district in 1896, has also given the writer every facility for examining his specimens and has lent many of them for further study and comparison. To each of these obliging friends the writer's thanks are due and are here very cordially tendered.

The present paper is a succinct statement of the results of a detailed study of this new material and of additional studies of all the specimens from this formation and province, in the Museum of the Survey. In connection therewith, the writer desires to express his obligations to Mr. Schuchert for several critical suggestions; to Mr. L. M. Lambe for valuable assistance in ascertaining the minute characters of several species and in checking off measurements; to the late Dr. S. A. Miller (of Cincinnati) for comparing specimens of two species of *Dolatocrinus* with the types of the species described by him, in connection with Dr. Gurley; and to Mr. Victor W. Lyon (of Jeffersonville, Indiana) for the comparison of two specimens with the types of *Megistocrinus rugosus* is his possession, and for the use of an original drawing or diagram of the plates composing the dorsal cup and tegmen of that species, by his father, the late Major Sidney S. Lyon.

CŒLENTERATA.

SPONGIÆ.

ASTRÆOSPONGIA HAMILTONENSIS, Meek and Worthen.

Astræospongia Hamiltonensis, Meek and Worthen. 1866. Proc. Chicago Acad. Sc., vol. I., p. 12; and (1868) Geol. Surv. Illinois, vol. III., p. 419, pl. 10, fig. 6.
Whiteaves. 1891. This volume, pt. 3, p. 198, pl. 28, figs. 1 and 1*a*.

Separate six rayed spicules, which appear to be referable to this species, have been found at Thedford and Bartlett's Mills, as stated elsewhere (*op. cit.*, p. 198) in this volume.

SUPPOSED BUNDLES OF SPICULES.

Two specimens, which Mr. Schuchert thinks are "anchoring bundles of spicules," were collected by him, in 1895, in the "Middle third of the section" at Thedford. Both are No. 26,462 of the United States National Museum Catalogue of Invertebrate Fossils. The more perfect of the two is a bundle of extremely slender and apparently simple spicules, upwards of an inch in length, forming a nearly cylindrical, narrow and densely aggregated mass at one end, but flattened, spreading and moderately expanded at the other.

SUPPOSED CLIONA BORINGS.

Twelve specimens of *Spirifera pennata*, Atwater (= *S. mucronata*, Conrad) collected by Mr. Schuchert from the "Upper third of the section" at Thedford, show peculiar markings which he thinks are "Cliona borings." For the greater part of their length these markings are rather minute grooves than burrows, but this circumstance is probably due to the exfoliation of the outer layer of the test of each of the Spirifers. These twelve specimens are No. 26,463 of the United States National Museum Catalogue of Invertebrate Fossils.

ANTHOZOA.

ALCYONARIA.

AULOPORA SERPENS (Goldfuss) Rominger.

Aulopora serpens (Goldfuss) Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 86, pl. 33, fig. 2.

Numerous specimens of a creeping, parasitic, auloporoid coral, which Mr. Schuchert has identified with this species, and which certainly agree very well with Rominger's description and figures of it, have been collected near Thedford and at Bartlett's Mills. Mr. Lambe, however, thinks that these specimens are merely young colonies of a species of *Syringopora*, and it is obvious that their internal structure is essentially as in that genus.

In his first report on the Palæontology of the Province of Ontario, Professor Nicholson refers a coral, which he says is "common in the Hamilton formation of the Township of Bosanquet, adhering to brachiopods and corals,"—to the *Aulopora cornuta* of Billings. Upon the strength of this identification the name of *A. cornuta* was inserted in a previous list of the fossils of this formation. But the types of *A. cornuta* are from the Corniferous limestone, and Mr. Lambe, who has recently studied their internal structure, is of the opinion that they are only parts of the basal reticulation of specimens of *Syringopora Maclurei*, Billings.

Mr. Schuchert also identifies two creeping attached corals that he collected at Bartlett's Mills, with the *Aulopora procumbens* of Davis, which is figured on Plate 73 of "Kentucky Fossils Corals." But that species has never been described, and there is nothing to show what its internal structure is like.

MONILOPORA ANTIQUA. (N. Sp.)

Plate 48, figs. 1, 2, 3 and 3*a*.

Corallum compound, at first attached to and either wholly or partially encircling foreign bodies, but apparently free and ramose ultimately. Most of the specimens that the writer has seen are parasitic on portions of the columns of crinoids, in some cases (as in fig. 1) completely enveloping them, except at the ends, and throwing out corallites in every direction: in others (as in fig. 2) only partially attached and spreading out into a thin, nearly flat, sub-circular lateral expansion, with all the corallites springing from its upper surface, and the lower surface consisting of a concentrically wrinkled epitheca. In this state of preservation the corallites are numerous, tubular, or somewhat conical and widening slightly outward, rather short, simple, bifurcate, trifurcate, or twice bifurcate, very unequal in size, the larger ones averaging about four millimetres in diameter at their summits. In two or three fragments, however, the most perfect of which is represented by figure 3, the branches are entirely free, and zigzag, with alternating corallites. In all the specimens the calyces are deep, the septa are almost obsolete and represented only by a faint minute longitudinal grooving of the inner surface of the calyx, and the upper or outer edges of the calyces are thin and finely denticulated by the minute longitudinal channelling of the exterior of the summits of the corallites.

Except upon the basal epitheca of laterally expanded specimens, the whole of the surface is minutely granulo-striate and marked by irregularly disposed and very minute granules, tubercles, or low, interrupted longitudinal ridges, with equally minute grooves or channels between them.

A longitudinal section of a portion of a free branch, which is bifurcate above, shows that the branch is hollow throughout its length, and quite devoid of tabulæ or of funnel-shaped diaphragms. The wall is rather thin, but no thin microscopic sections of any portion of it have yet been made, to show whether its structure is minutely cancellated or not.

This well-marked species appears to be not uncommon at Thedford, where specimens were collected by Mr. Johnson Pettit in 1868, by the

Rev. Hector Currie in 1880, by the Rev. J. M. Goodwillie in 1882, by Dr. H. M. Ami in 1883, and by the writer in 1889. So far as the writer is aware, it is the first species that has been recognized as occurring in rocks of Devonian age. It is easily distinguished by its very peculiar surface ornamentation, which, although rather difficult to describe adequately in words, is well shown by figure 3*a*.

ZOANTHARIA.

(Tetracoralla, Hæckel : = Rugosa, Edwards and Haime.)

HELIOPHYLLUM JUVENE, Rominger. (Sp.)

Cyathophyllum juvene, Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 100, pl. 35, upper row, the three smaller specimens on the right side of the plate.
Heliophyllum juvene, Calvin. 1888. Amer. Geologist, vol. I., p. 83.

"Widder, Canada West." "A very constant form found in association with *Heliophyllum Halli*, resembling it in all particulars, but in all proportions smaller." Rominger. The figures of these two forms, in the Fossil Corals of Michigan, do not impress one with their distinctness. Professor Calvin says (*op. cit.*) that *H. juvene* is found in the "Middle division of the Hamilton group on the Rivière aux Sables."

BLOTHROPHYLLUM CONATUM, Hall. (Sp.)

Cyathophyllum conatum, Hall. 1876. Illustr. Devonian Foss., pl. 31, figs. 1-14.

Mr. Schuchert has collected several specimens of a coral, which he has identified with this species and referred to the genus *Blothrophyllum*, from the "Middle third of the section," near Thedford and at Bartlett's Mills. These are No. 26,603 of the United States National Museum Catalogue of Invertebrate Fossils.

PHILLIPSASTRÆA VERNEUILI, Edwards and Haime.

Phillipsastræa Verneuili, Edw. and Haime. 1851. Mon. Polyp. Foss. Terr. Palæoz., p. 447, pl. 10, fig. 5.
" " Billings. 1859. Canad. Journ., N. S., vol. IV., p. 127, fig. 34
" " Billings. 1863. Geol. Canada, p. 365, fig. 363.

In 1895 Mr. Schuchert succeeded in finding one good specimen of this species, which is so common in the Corniferous limestone of Ontario, in the "Middle third of the section" at Bartlett's Mills.

CYSTIPHYLLUM CONIFOLLE, Hall.

Cystiphyllum conifollis, Hall. 1876. Illustr. Devonian Foss., pl. 30, figs. 3-9.

"Town" (evidently a typographical error for township) "of Bosanquet." Hall, 1876. Thedford and Bartlett's Mills, in the "Middle third of the section"; C. Schuchert, 1895. Perhaps only a variety of *C. Americanum*, Edwards and Haime.

(Hexacoralla, Hæckel : = Tabulata, Edwards and Haime.)

FAVOSITES ALPENENSIS, Winchell.

Favosites Alpenensis, Winchell. 1866. Rep. Lower Penins. Mich., p. 88.
Favosites Hamiltonensis, Rominger (Pars). 1876. Geol. Surv. Mich., Fossil Corals, p. 27, pl. 7, fig. 3.
Fávosites Gothlandica, (Lamarck). Var. Whiteaves. 1892. This vol., pt. 4, p. 272.

Mr. Schuchert has identified with this species three specimens of a coral which he collected in 1895 from the "Middle third of the section" near Thedford. These specimens, which the writer has examined, are evidently conspecific with the coral from lakes Manitoba and Winnipegosis referred to on page 272 of the fourth part of this volume as a variety of *Favosites Gothlandica*, Lamarck. The latter determination was based upon the largely extended definitions of the characters of *F. Gothlandica*, by E. Billings and Prof. H. A. Nicholson, and more particularly on Mr. Billings's statements that the size of the tubes in the corals which he refers to that species, "ranges from three-fourths of a line to a little more than two lines,"*, and that "the spiniform rays (or septa) exist in both upper Silurian and Devonian specimens of *Favosites*."†

It is not clear to the writer why Dr. Rominger, in his monograph of the fossil corals of Michigan, proposes to substitute the new name *Favosites Hamiltonensis* for the *F. Alpenensis* and *F. dumosus* of Winchell.

FAVOSITES ARBUSCULA, Hall.

Favosites arbuscula, Hall. 1876. Illustr. Devonian Fossils, pl. 36, figs. 1-9.
" " Calvin. 1888. Amer. Geologist, vol. X., p. 83.

A common branching species, which was first recognized as occurring in the Hamilton formation of Ontario by Professor S. Calvin. So far, it has been found only in the "Middle third of the section," near Thedford, and at Bartlett's Mills, where numerous specimens were collected by Mr. Schuchert in 1895. The list of fossils of the Hamilton formation of Ontario in the fifteenth chapter of the "Geology of Canada," contains the names of *Favosites Gothlandica*, *F. turbinata*, *F. polymorpha*, *F. cervicornis* and *F. hemispherica*. New specific names have since been proposed for three of these, and it is now apparent to the writer that the *F. Gothlandica* of this list is *F. Billingsii*, Rominger; that the *F. polymorpha* is *F. clausa*, Rominger; and the *F. cervicornis*,—*F. arbuscula*, Hall.

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* Canadian Journal, New Series, vol. IV., p. 102.

† On the same page of the same publication.

RÆMERIA RAMOSA. (N. Sp.)

Plate 48, figs. 4 and 5.

Corallum compound, in the few specimens which the writer has seen, which appear to be terminal branchlets of ramose colonies, either club-shaped and slightly compressed, or fan-shaped, strongly compressed and somewhat lobate above, more or less branched, in all cases erect and usually widening toward the summit. Corallites simple, short, tubular and slightly expanding, but closely amalgamated at the sides, radiating from an imaginary median axis, but appressed and very slightly divergent, their apertures directed outward and upward, all, but a few terminal ones, opening at the sides. Calyces deep, septa rudimentary, almost obsolete, apparently represented by numerous minute isolated tubercles, or possibly spine bases, with which their inner surface is strewn. Apertures of the calyces variable in outline, but mostly subovate or almost circular, the larger ones averaging from four to five millimetres in their longer diameter. Mural pores rather large and irregularly disposed.

Surface nearly smooth, but marked with a few faint transverse striæ of growth, which are scarcely visible without the aid of a lens. Where portions of the surface were rubbed down to show the internal structure, there are indications of funnel-shaped diaphragms immediately below the calyces.

The writer has seen only four specimens of this species, all of which are now in the Museum of the Survey. Two of these were collected by Mr. Townsend and are labelled by him, Township of Bosanquet; one was found by Mr. Kernahan, at Thedford; and one by the Rev. Hector Currie, at Stony Point, four miles east of Kettle Point, Lake Huron. It is just possible that these specimens should be referred to *Vermipora*, Hall, as redescribed by Rominger on pages 68 and 69 of his Fossil Corals of Michigan, but in *Vermipora* the transverse diaphragms or tabulæ are said to be flat. All four show the "intercalation of new tubes by lateral gemmation," which is one of the characters of Rominger's *V. fasciculata*.

HYDROMEDUSÆ.

HYDROIDA.

CLATHRODICTYON RETIFORME, Nicholson and Murie. (Sp.)

Stylodictyon retiforme, Nicholson and Murie. 1878. Journ. Linn. Soc., Zoology, vol. XIV., p. 222, pl. 2, fig. 14, and pl. 3, figs. 1-3.
Clathrodictyon retiforme, Nicholson. 1887. Ann. and Mag. Nat. Hist., Ser. 5, vol. XIX p. 13, pl. 3, figs. 6-8.

"Rare in the Hamilton formation (Devonian) at Arkona, Ontario," where it was discovered by Dr. G. J. Hinde. Nicholson.

STROMATOPORA MAMILLATA, Nicholson.

Stromatopora mammillata, Nicholson. 1873. Ann. and Mag. Nat. Hist., Ser. 4, vol. XII., p. 94, pl. 4, fig. 4; and (1874) Rep Pal. Prov. Ontario, p. 17, pl. 1, fig. 4.

Mr. Schuchert refers to this species a few good specimens that he collected from the "Middle third of the section" at Bartlett's Mills, and that are No. 26,596 of the United States National Museum Catalogue of Invertebrate Fossils. It is to be observed, however, that the types of *S. mamillata* are from the Corniferous limestone, that they have not yet been examined microscopically, and that no microscopic sections have been made of any of Mr. Schuchert's specimens.

STROMATOPORELLA INCRUSTANS, Hall and Whitfield. (Sp.)

Stromatopora (*Cænostroma*) *incrustans*, Hall and Whitfield. 1873. Twenty-third Rep. N.Y. St. Cab. Nat. Hist., p. 227, pl. 9, fig. 3.
Stromatopora nulliporoides, Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 78.
Stromatoporella incrustans, Nicholson. 1891. Ann. and Mag. Nat. Hist., Ser. 6, vol. VII., pp. 309 and 310, foot note.

"Hamilton formation; Arkona. Also in the Corniferous Limestone, Port Colborne." Nicholson. The species is abundant in the neighbourhood of Thedford.

ECHINODERMATA.

CRINOIDEA.

GILBERTSOCRINUS SPINIGERUS, Hall. (Sp.)

Trematocrinus spinigerus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 128.
Goniasteroidocrinus spinigerus, Meek and Worthen. 1866. Geol. Surv. Illinois, vol. II., p. 222.
" " S. A. Miller. 1877. Cat. Amer. Palæoz. Fossils, p. 80.

Ollacrinus spinigerus, Wachsmuth and Springer. 1881. Rev. Palæocrinoidea, pt. 2, p. 219.
" " Whiteaves. 1887. This volume, pt. 2, (advance sheets) p. 103; and (1889) pl. 13, figs. 4, 4, *a.-b.*
Goniasteroidocrinus spinigerus, S. A. Miller. 1889. N. Amer. Geol. and Palæont., p. 250.
Gilbertsocrinus spingerus, Wachsmuth and Springer. 1897. N. Amer. Crinoidea Camerata, vol. I., p. 247, pl. 15, figs. 3, *a-c.*

In the volume last cited, the generic name *Ollacrinus* (Cumberland, 1826) is rejected for this and other species, on the ground that it "cannot be looked upon as lawfully published," and the name *Gilbertsocrinus* (Phillips, 1836) adopted instead.

DOLATOCRINUS CANADENSIS, Whiteaves.

Dolatocrinus Canadensis, Whiteaves. 1887. This vol., pt. 2, (advance sheets) p. 99; & (1889) pl. 12, figs. 3 & 3 *a.*
" " Wachsmuth and Springer. 1897. N. Am. Crinoidea Camerata, vol. I., p. 315, pl. 25, figs. 7, *a-b.*

This crinoid, which has three primary arms in each ray, has recently been redescribed and refigured in the beautifully illustrated monograph by Wachsmuth and Springer quoted above. The species would appear to be rare, as the specimen from Thedford figured on Plate 12 of this volume is still the only one that the writer has seen.

DOLATOCRINUS SUBACULEATUS. (N. Sp.)

Plate 48, figs. 6, 6 *a*, and 6 *b*.

Calyx depressed hemispherical, broader than high and flattened below, rather small for the genus, not much exceeding fifteen millimetres in maximum breadth in the few specimens that the writer has seen. Primary arms in each ray, two. Basals and lower halves of the radials deeply incurved, like those of *D. lacus*, Lyon (as recently described by Wachsmuth and Springer on pages 311 and 312 of the first volume of their monograph of the "North American Crinoidea Camerata"), and formed, as in that species, into an "inverted funnel-shaped cavity which is wider than the column, the latter touching only the bottom part." Around the base there is a large pentagon, the outer boundary of which is formed by a narrow continuous ridge which connects the radials laterally. Each of the angles of this pentagon is intersected vertically by a linear ridge, which occupies the middle of each ray, and each side of this pentagon forms the base of a triangle, the apex of which is the centre of the first interbrachial. The linear ridge along the median line of each ray is prominent, acute, and bears two laterally compressed, rather obtusely pointed tubercles, one at the midheight of the ray and in the centre of the first costal, and one at the point of bifurcation of the ray and in the centre of the second costal. The first interbrachials are ornamented with a large, prominent, upward pointed tubercle in the centre, with linear ridges radiating from it, and the tegmen with numerous, very small tubercles.

Basals small, inverted: radials hexagonal, broader than high: first costals quadrangular, also broader than high: second costals pentangular and much broader than high: distichals 1 x 2. A respiratory, slit-like opening on one side only of each arm base, and hence ten in all, each opening linear, well defined, placed close to and parallel with the ambulacral furrow. First interbrachials single and very large: second interbrachials also single, pentagonal and bent abruptly inward at their midheight. Tegmen composed of rather numerous large plates, the anal tube subcentral and rising gradually therefrom.

The foregoing description is based upon three well preserved and nearly perfect specimens of the calyx, one collected at Bartlett's Mills by the Rev. J. M. Goodwillie in 1882 and presented by him to the Museum of the Survey, and two found quite recently at Thedford by Messrs. Kernahan and Kearney. The first of these is the specimen referred to on page 98 of the second part of this volume and identified with *D. liratus* (Hall), on the authority of Mr. Wachsmuth, who thought that it might be a small form of that species, although it has "only 1 x 2 secondary radials." In view of the more detailed and illustrated description of *D. liratus* published by Wachsmuth and Springer, this identification seems to be no longer tenable, and the three specimens now under consideration more probably represent a small, strongly and very peculiarly sculptured, ten-armed and previously undescribed species, perhaps most nearly allied to *D. pulchellus* of Miller and Gurley, which, however, has a respiratory slit on both sides of each arm base, or twenty slits in all. Dr. S. A. Miller, who has kindly examined one of these specimens, regards it as quite distinct from *D. pulchellus*, and from any species known to him.

DOLATOCRINUS. (N. Sp.)

A single specimen of the calyx of a large *Dolatocrinus* which has a different arm formula to either of the two preceding species, and which is therefore presumably distinct from both, was collected at Thedford by the Rev. Hector Currie in 1882. On the authority of Mr. Wachsmuth, who thought that it has four primary arms in each ray, this specimen was identified with *D. lamellosus*, the *Cacabocrinus lamellosus* of Hall, on page 99 of the second part of this volume. But, in the first volume of their monograph of the American Crinoidea Camerata, published in 1897, (page 311), Messrs. Wachsmuth and Springer say that they have been unable to get authentic specimens of Hall's *Cacabocrinus lamellosus* and *C. Troostii*, and that the descriptions of them are too general for specific determination. Moreover, the original types of *C. lamellosus* are stated by Hall to be from the Upper Helderberg limestone.

Dr. S. A. Miller, who has examined this specimen also, has convinced the writer that it really has seventeen arms, its arm formula being $4+3+3+3+4=17$, and thinks that it should be regarded as the type of a new species. It is, however, unfortunately too imperfect to admit of a satisfactory description of its characters, although previously but incorrectly represented as "nearly perfect," when most of its surface was covered by the matrix.

DOLATOCRINUS. (Species uncertain.)

Perhaps a var. of *D. tuberculatus*, Wachsmuth and Springer.

Cfr. *Dolatocrinus tuberculatus*, Wachsmuth and Springer. 1897. N. Amer. Crinoidea Camerata, vol. I., p. 324, pl. 25, fig. 3.

A single specimen of a large *Dolatocrinus* with a surface ornamentation differing materially from that of the preceding species, but which does not show the arm formulæ, was collected at Thedford by Mr. Kearney in 1895 and is now in the Museum of the Survey. The dorsal cup of this specimen is apparently similar to that of *D. tuberculatus* in size, shape and sculpture, but the prominent circular rim at the base, which encircles the upper part of the column, is proportionately larger and thicker, so that the five large pointed tubercles which surround it, almost touch its outer edge and are not placed at some distance from it. In the type of *D. tuberculatus*, as figured in the monograph cited, the basal rim is about six millimetres and a half in its maximum diameter and the summits of the five large tubercles nearest to it are about five mm. from its outer margin. The basal rim of the Thedford specimen is fully ten mm. in diameter and the summits of the five large tubercles nearest to it are not more than two mm. from its outer margin. Although the external sculpture of this specimen is well preserved, the sutures between the plates of which the dorsal cup is composed are entirely covered by the matrix, so that it is not yet practicable to compare the number and relative shape of these plates with those of *D. tuberculatus*.

Nothing is known of the ventral disk or arms of that species, and of the Thedford specimen all that is preserved is a large portion of the dorsal cup, with most of the upper part of one of the rays. On the left side of this ray there was clearly one arm, but on the right side it is scarcely practicable to decide whether there was one arm or whether there were two.

MEGISTOCRINUS RUGOSUS, Lyon and Casseday.

Megistocrinus rugosus,	Lyon and Casseday. 1859. Am. Journ. Sc. and Arts, ser. 2, vol. XXVIII., p. 243.
" "	Whiteaves. 1887. This volume, pt. 2 (advance sheets) p. 101,
" "	Wachsmuth and Springer. 1897. N. Amer. Crinoidea Camerata, vol. II., p. 542, pl. 48, figs. 6, *a-c*.

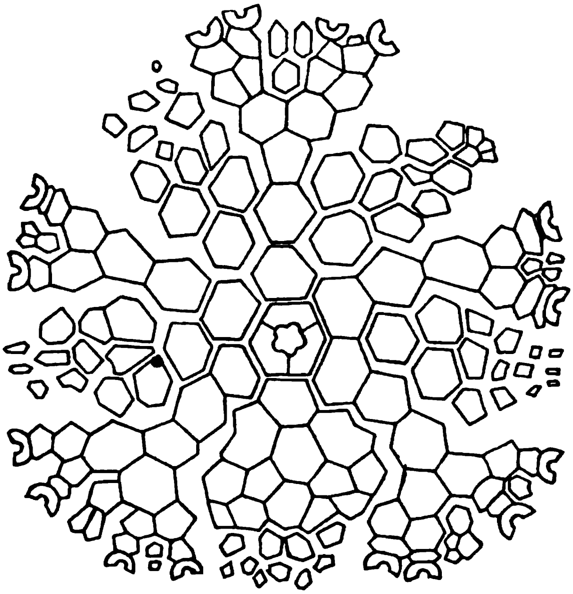

Fig. 1. *Megistocrinus rugosus*. Diagram of the plates composing the dorsal cup and tegmen of one of the type specimens of this species, from Louisville, Kentucky. From an original drawing by the late Major Sidney S. Lyon, lent by Mr. Victor W. Lyon. *a*. Anal side.

A small specimen, which was regarded by Mr. Wachsmuth as a young individual of this species, was collected near Thedford by the Rev. J. M. Goodwillie in 1882, and presented by him to the Museum of the Survey. A similar, but much larger and in some respects better preserved specimen, was picked up in the Rivière aux Sables, near Thedford, in 1891, by Mr. G. H. Stone (of Almont, Michigan), who has also presented it to the Museum of the Survey. Both of these specimens have been sent to Mr. Victor W. Lyon, of Jeffersonville, Indiana, for comparison with the types of *M. rugosus* in his possession, and in regard to the former Mr. Lyon writes as follows, in a letter dated Nov. 5, 1897 :—"I have compared the two Canadian crinoids with type specimens of *Megistocrinus rugosus*, Lyon and Casseday, and find that your specimens are young specimens of that species. All *M. rugosus* that I have seen have sixteen arms. The larger one you sent has sixteen arms, and the shape and ornamental markings are identical with the type specimens, although somewhat worn. The markings on the smaller one are more distinct, but the basal plates do not show so well as in the larger one. Both are true *Megistocrinus rugosus.* I am obliged to you for sending these two crinoids, for I know now that *M. rugosus* has an extended distribution."

The original types of *M. rugosus* are from the "quarries at Bear Grass Creek, near Louisville, Kentucky," though Clarke County, Indiana, is the first locality indicated for this species by Wachsmuth and Springer (*op. cit.*, p. 543).

GENNÆOCRINUS ARKONENSIS. (N. Sp.)

Plate 48, figs. 7 and 7*a*, and the accompanying cut.

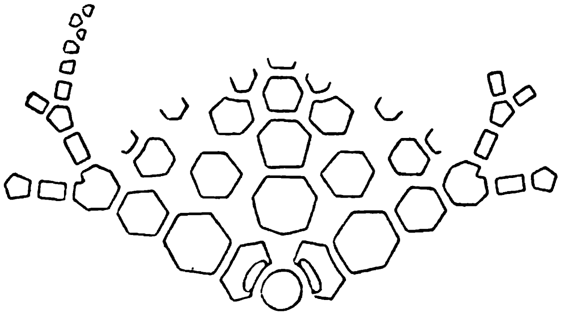

Fig. 2. *Gennæocrinus Arkonensis.* Diagram of all the plates of the dorsal cup that are visible in the specimen figured on Plate 48, with some of those at the commencement of the arms. Three times the natural size.

Calyx unusually small for the genus, the most perfect specimen known (the one figured) being about ten millimetres in its maximum breadth, though slightly and abnormally compressed, and a little broader than high: arms very long in proportion to the size of the calyx, pinnules also long, numerous and densely crowded. Dorsal cup semiglobose, cup-shaped, widening gradually upward and widest above, its surface markings very faint and indistinctly defined. In the median line of the radial and first costal each ray is marked by an obscure, low, rounded, longitudinal ridge, which bifurcates in the upper portion of the second costal. The surface of the lower and larger plates also, especially that of the radials and first "interbrachials," is marked with six or seven obscure, low, depressed-convex, radiating ridges near their outer margin, the central portion being entire and either smooth or occasionally bearing a minute tubercle. All the interbrachials, except the first, appear to be nearly or quite smooth.

Basals three, hexagonal, rather more than twice as broad as high, slightly concave at their lower margin, which is thickened and projects outward in such a way as to form a narrow elevated rim. Radials and costals as high as broad, the radials and first costals hexagonal, the second costals heptagonal, but with an angular notch in the upper margin, between the two surfaces which articulate with the bases of each pair of primary distichals. Distichals 2 x 10: primary distichals rectangular and higher than wide, secondary distichals pentagonal: palmars rectangular, nearly square: arms biserial and apparently eight in each ray. "Interbrachials" 1, 3, 5 (though the plates in this genus which Wachsmuth and Springer call the first interbrachials seem to the writer to be true interradials), the first large and heptagonal, the others hexagonal, decreasing slowly in size upward and succeeded by a row of about seven smaller plates. Characters of the tegmen unknown.

Column long, slender, in some cases apparently adherent to foreign bodies by a small, thin, laterally expanded base of attachment: its segments cylindrical or slightly swollen in the middle externally, circular in section, uniform in breadth and distinctly crenulated on both of their articulating faces.

Good fragments of the arms and pinnules of this crinoid are not rare at Bartlett's Mills, but the only specimens with the dorsal cup preserved that the writer has seen are two collected at that locality by Mr. Kearney, one in 1895, and the other in 1896. The one collected in 1895, which has been kindly lent by Mr. Schuchert, belongs to the United States National Museum, and is No. 26,470 of its Catalogue of Invertebrate Fossils, and the one collected in 1896, which is figured on Plate 48, is now in the Museum of the Survey. Both of them have the whole of one side of the dorsal cup buried in the matrix. The specimen figured shows, on one side, two rays and a considerable portion of their arms and pinnules *in situ*, with the interradial or "interbrachial" plates between them, and a detached portion of the column ;—and on, the other, a beautifully preserved aggregation of arms and pinnules, with another small piece of the column. In a specimen from Thedford, which consists of the two posterior segments of the column only, and which seems to be referable to this species, the terminal segment is attached to a flattened branching polyzoon by a thin lateral expansion.

An apparently well marked species, characterized by its small dorsal cup, slender column, and, more especially, by its very feeble and almost obsolete surface markings.

BOTRYOCRINUS CRASSUS, Whiteaves.

Homocrinus crassus, Whiteaves. 1887. This volume, pt. 2, (advance sheets), p. 95; and (1889,) pl. 12, fig. 2.

In regard to this species Mr. F. A. Bather makes the following remarks, on page 103 of his "Crinoidea of Gotland": "This is founded on a dorsal cup from the Hamilton group, which cannot be distinguished from that of a *Botryocrinus*. The posterior side of the cup is not shown in the figure, but Mr. Whiteaves has very kindly sent me the type specimen, the evidence of which is quite clear."

ANCYROCRINUS BULBOSUS, Hall.

Plate 48, figs. 8 and 9.

Ancyrocrinus bulbosus, Hall. 1862. Fifteenth Rep. N.Y. St. Cab. Nat. Hist., p. 118, pl. 1, figs. 25 and 26.
" " Whiteaves. 1887. This vol., pt. 2, (advance sheets) p. 103; and (1889,) pl. 13, fig. 5.

Numerous specimens of the anchor-like posterior extremity of the column of crinoids, which seem to agree in all essential particulars with Professor Hall's description and figures of *A. bulbosus*, were collected at Stony Point, Lake Huron, a few years ago, by the Rev. Hector Currie, who has presented four of them to the Museum of the Survey. Each of these specimens has four strongly developed "obliquely ascending, spine-like processes," or "lateral extensions," which are rarely less than a quarter of an inch and sometimes fully half an inch in length, when unbroken. In two of the specimens these processes originate at about the same height and are arranged in a rather regular cruciform manner, but in the other two they originate at different heights and are very irregularly disposed. No tendency to become square or nearly square anteriorly is seen in any of them, although the axial canal of each is cruciform, as viewed in transverse section at the anterior end, and none show any indication of division into segments.

BLASTOIDEA.

Plate 48, figs. 8 and 9.

Pentremites Lycorias, Hall. 1863. Sixteenth Rep. N. Y. St. Cab. Nat. Hist., p. 123.
" " Calvin. 1888. American Geologist, vol. I., p. 84.

"Middle division of the Hamilton group about two miles south-west of Widder" (Thedford), Professor S. Calvin, *op. cit.* According to Etheridge and Carpenter, on page 132 of their Catalogue of the Blastoidea in the Geological Department of the British Museum, this species may belong to the genus *Granatocrinus*, but it is equally probable that it should be referred to *Mesoblastus* or *Pentremitidea*. On page 138 of that publication it is placed under the heading "Genera undetermined."

ASTEROIDEA.

PALÆASTER EUCHARIS, Hall.

Palæaster eucharis, Hall. 1868. Twentieth Rep. N. Y. St. Cab. Nat. Hist., p. 330, pl. 9, figs. 3, 3*, and 4.

"At Bartlett's Mills, Mr. Kernahan found and gave me a ray of *Palæaster eucharis*, Hall. It is from the Lower third of my section." C. Schuchert, in a letter to the writer, dated July 6, 1897.

VERMES.

AUTODETUS LINDSTRŒMI, Clarke.

Autodetus Lindstræmi, Clarke. 1894. Amer. Geologist, vol. XIII., p. 329, figs. 1, 2 and 3; p. 330, figs. 4, 5, 6; and p. 334.

Not very uncommon about Thedford, where specimens were collected many years ago by the Rev. Hector Currie, and more recently by Mr. Kernahan and Mr. Kearney. All the specimens from this locality that the writer has seen, are detached from the foreign bodies to which they were probably once attached, the scar of attachment being very small.

MOLLUSCOIDEA.

POLYZOA.

INTRAPORA COSCINIFORMIS, Nicholson. (Sp.)

Ptilodictya cosciniformis, Nicholson. 1875. Geolog. Mag., N.S., vol. II., p. 35, pl. 2, figs. 2, *a-b.*; and Rep. Pal. Prov. Ontario, p. 80, pl. 2, figs. 2, *a-b*.
Coscinium cosciniforme, Hall. 1887. Pal. N. York, vol. VI, p. 239.
Intrapora cosciniformis, Ulrich. 1890. Geol. Surv. Illinois, vol. VII., p. 532, pl. 43, figs. 6 and 6*a*.

In the Museum of the Survey this species is represented by portions of zoaria collected at Thedford by the Rev. J. M. Goodwillie in 1882, and by an unusually fine specimen nearly three inches in breadth, by two inches and a-half in height, collected at or near Bartlett's Mills by Mr. Joseph Townsend in 1885.

INTRAPORA ELEGANTULA, Hall. (Sp.)

Coscinella elegantula, Hall. 1887. Pal. N. York, vol. VI, p. 239, pl. 64, figs. 9-12.

"Hamilton group, Widder, Ontario, Canada." Hall. Ulrich, in a footnote to page 532 of the eighth volume published by the Geological Survey of Illinois, expresses the opinion that *Coscinella* is synonymous with *Intrapora*, and that *C. elegantula* is probably identical with *I. cosciniformis*.

COSCINIUM STRIATUM, Hall.

Coscinium striatum, Hall. 1887. Pal. N. York, vol. VI., p. 238, pl. 64, figs. 13-16.

"Hamilton group, Widder, Ontario, Canada." Hall. A well preserved and very characteristic specimen of this species, in the Museum of the Survey, was collected at the same locality by Rev. J. M. Goodwillie in 1882.

CYSTODICTYA MEEKI, Nicholson. (Sp.)

Ptilodictya Meeki, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 123; and Rep. Pal. Prov. Ontario, p. 97, and figs. 34 *a-c* on p. 98.
Cystodictya Meeki, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

"Rare in the Hamilton formation of Bartlett's Mills, near Arkona." Nicholson. Thedford, Rev. Hector Currie, 1882.

CYSTODICTYA INCISURATA, Hall. (Sp.)

Stictopora incisurata, Hall. 1881. Trans. Albany Inst., vol. X., p. 189.
" " " 1884. Rep. St. Geologist for 1883, p. 38.
" " " 1887. Pal. N. York, vol. VI., p. 241, pl. 60, figs. 1-18.
Cystodictya incisurata, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

Thedford, in the "Lower third of the section," three specimens (No. 26,546 of the United States National Museum Catalogue of Invertebrate Fossils) collected in 1895, and determined by Mr. Schuchert.

CYSTODICTYA RECTILINEA, Hall. (Sp.)

Stictopora rectalinea, Hall. 1887. Pal. N. York, vol. VI., p. 245, pl. 63, fig. 23.
Cystodictya rectalinea, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

"Hamilton group, West Williams, Ontario, Canada." Hall.

CYSTODICTYA (?) INCRASSATA, Hall.

Stictopora incrassata, Hall. 1881. Trans. Albany Inst., vol. X., p. 190.
" " " 1884. Rep. St. Geologist for 1883, p. 47.
" " " 1887. Pal. N. York, vol. VI., p. 249, pl. 63, fig. 23.

"Hamilton group, West Williams, Province of Ontario, Canada." Hall.

SEMIOPORA BISTIGMATA, Hall.

Semiopora bistigmata, Hall. 1881. Trans. Albany Inst., vol. X., p. 193.
" " " 1884. Rep. St. Geologist for 1883, p. 51.
" " " 1887. Pal. N. York, vol. VI., p. 262., pl. 62, figs. 27-29.

"Hamilton group, West Williams, Ontario, Canada." Hall.

SCALARIPORA CANADENSIS. (N. Sp.)

Plate 48, figs. 10, 10*a* and 10*b*.

Zoarium consisting of stems that are triangular and almost equilateral in transverse section, the broadest of the three faces having a maximum diameter of about 7·5 mm., and the narrowest of 6·5 mm. Faces shallowly concave or nearly flat: angles acute, forming three sharp, prominent, and nearly straight but rather irregular, longitudinal ridges. Transverse ridges distant, nearly as far apart as the faces are broad, not continuous in either of the two fragments examined, developed (or present) on two of the faces in the longer of these fragments, and on only one face in the shorter. Whole surface celluliferous, apertures averaging from about 0·16 mm. to 0·25 mm. in diameter, usually rather more than their own diameter apart, or about equal to it in distance, subcircular, with a slightly elevated annular peristome and arranged obscurely in more or less regular diagonal rows, seven or eight in three mm. Internal structure not observed.

Thedford, G. Kernahan, 1895 : two specimens, one seventeen millimetres in length and showing two transverse ridges and a partially developed intermediate one ; the other a little more than ten mm. in length and showing only one transverse ridge. Both of these fragments are now in the United States National Museum, and are No. 26,544 of its Catalogue of Invertebrate Fossils. They were first referred to the genus *Scalaripora* by Mr. Schuchert, and seem to the writer to differ from *S. separata*, Ulrich, from the Hamilton formation at Thunder Bay, Michigan,* to which they seem to be most nearly related, by the much greater size of the branches, and apparently also by the irregularity and want of continuity of the transverse ridges.

STREBLOTRYPA HAMILTONENSIS, Nicholson. (Sp.)

Ceriopora (?) Hamiltonensis, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 161; and Rep. Pal. Prov. Ontario, p. 97, fig. 33.

Acanthoclema Hamiltonense, Hall. 1887. Pal. N. York, vol. VI., p. 191, pl. 55, figs. 18-26.

Rhombopora Hamiltonensis, Nicholson. 1889. In Nicholson and Lyddeker's Man. Palæont., vol. I., p. 610, fig. 455 B; and fig. 478 on p. 632.

Streblotrypa Hamiltonensis, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 648.

A common species in the neighbourhood of Thedford.

FENESTELLA NICHOLSONI. (Nom. prov.)

Fenestella cribrosa, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 106, figs. 43, *a*, *b*. But probably not *F. cribrosa*, Hall, 1852, (Pal. N. York, vol. II., p. 166, pl. 40 D, figs. 3, *a*, *b*,)—which is from the Niagara limestone.

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* Geological Survey of Illinois, vol. VIII., 1890, p. 507, pl. 43, fig. 3.

Not uncommon in the Hamilton Group at Widder and at Bartlett's Mills, near Arkona." Nicholson.

FENESTELLA ARKONENSIS. (Nom. prov.)

Fenestella tenuiceps, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 106, figs. 44, *a-b*. But probably not *F. tenuiceps*, Hall, 1852 (Pal. N. York, vol. II., p. 165, pl. 40 D, figs. 2, *a*, *h*) which is a fossil of the Clinton and Niagara formations of the State of New York, and Ontario.

"Common in the Hamilton Formation at Bartlett's Mills, near Arkona." Nicholson.

RETEPORA PRISCA, Nicholson.

Retepora prisca (Goldfuss) Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 101, figs. 38, *a*, *b*.

"Common in the Corniferous Limestone of Ridgeway and Port Colborne; also in the Hamilton Group at Bartlett's Mills, near Arkona." Nicholson.

A specimen of this species, from Ridgeway, has been presented to the Museum of the Survey by Professor Nicholson, but the writer has not seen an authentically named, or very closely similar specimen from the Hamilton formation. *R. prisca*, Goldfuss, is the type of D'Orbigny's genus *Reteporina*, but Zittel, in the first volume of his Handbuch der Palæontologie (page 600) makes both *Retepora* and *Reteporina* synonyms of *Fenestella.*

POLYPORA ARKONENSIS, S. A. Miller.

Polypora tuberculata, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 162; and Rep. Pal. Prov. Ontario, p. 100, figs. 37, *a-c*. But, according to Ulrich (Geol. Surv. Illinois, vol. VIII., p. 595) not *P. tuberculata*, Prout, 1859.

Polypora Arkonensis, S. A. Miller. 1883. Am. Palæoz. Foss., 2nd. Ed., p. 316.

Rare in the Hamilton group at Bartlett's Mills. Nicholson.

PTILOPORA STRIATA, Hall.

Ptilopora striata, Hall. 1881. Trans. Albany Inst., vol. X., p. 196.
" " " 1884. Rep. St. Geologist for 1883, p. 58.
" " " 1887. Pal. N. York, vol. VI., p. 283, pl. 66, figs. 30-33.

"West Williams, Ontario, Canada." Hall.

TREMATOPORA CARINATA, Hall.

Trematopora (*Orthopora*) *carinata*, Hall. 1887. Pal. N. York, vol. VI., p. 179, pl. 55, fig. 2; and pl. 56, fig. 3.

"Hamilton group, West Williams, Ontario, Canada." Hall.

LEIOCLEMA MINUTISSIMUM, Nicholson. (Sp.)

Callopora minutissima, Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 77, figs, 43, a, b.
? *Fistulipora minuta*, Rominger. 1866. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p. 120.
? *Leioclema minutum* (Rominger) Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 427.

Not uncommon at Bartlett's Mills. If this species be the same as the *Fistulipora minuta* of Rominger, as Ulrich thinks it may be, it of course will have to be called *Leioclema minutum*.

FISTULIPORA UTRICULUS, Rominger.

Fistulipora utriculus, Rominger. 1866. Proc. Ac. Nat. Sc. Philad., vol. VIII., p. 121.
" " Nicholson & Foord. 1885. Ann. and Mag. Nat. Hist., Fifth Ser., vol. XVI., p. 508, pl. 16, figs. 1, 1, *a-e*; and pl. 17, figs. 1 and 1*a*.

Common at Thedford and Bartlett's Mills. In the Museum of the Survey there are two of the original types of the species, from "Widder," presented by Dr. Rominger; two specimens from practically the same locality, collected by Mr. Pettit in 1868; and seven specimens from Bartlett's Mills, presented by Professor H. A. Nicholson in 1890.

FISTULIPORA ROMINGERI, Nicholson & Foord.

Fistulipora crassa, Rominger. 1866. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p. 121. But not *Heteropora crassa*, Lonsdale. 1839 (in Murchison's Silurian System, pl. 15, figs. 14 and 14*a*) which Nicholson and Foord say is a *Fistulipora*.
Fistulipora Romingeri, Nicholson and Foord. 1885. Ann. and Mag. Nat. Hist., Fifth Ser., vol. XVI., p. 506.

The only authentic examples of this species in the Museum of the Survey are two of the types from "Widder" presented by Dr. Rominger.

FISTULIPORA VARIAPORA, Hall.

Thallostigma variapora, Hall. 1881. Trans. Albany Inst., vol. X., p. 184.
" " " 1884. Rep. State Geol. for 1883, p. 18.
Fistulipora variapora, Hall. 1887. Pal. N. York, vol. VI., p. 210, pl. 58, figs. 9-14.

"Hamilton group, West Williams, Ontario, Canada." Hall.

FISTULIPORA (?) SUBTILIS, Hall.

Thallostigma subtilis, Hall. 1881. Trans. Albany Inst., vol. X., p. 187.
" " " 1884. Rep. State Geol. for 1883, p. 30.
Fistulipora (?) subtilis, Hall. 1887. Pal. N. York, vol. VI., p. 233. Not figured.

"Hamilton Group, West Williams, Ontario, Canada." Hall.

LICHENALIA STELLATA, Hall.

Lichenalia stellata, Hall. 1881. Trans. Albany Inst., vol. X, p. 183.
" " " 1884. Rep. State Geol. for 1883, p. 30.
" " " 1887. Pal. N. York, vol. VI, p. 195, pl. 58, figs. 15 and 16.

Same formation and locality as for the preceding species. Hall.

In the eighth volume of the official reports of the Geological Survey of Illinois, published in 1890, Mr. Ulrich maintains that *Lichenalia*, Hall, is synonymous with *Fistulipora*. If this be the case, it of course follows that this and the two following species should be referred to *Fistulipora*. On the other hand, Mr. G. B. Simpson, in his "Handbook of the Genera of the North American Palæozoic Bryozoa," published in 1897, claims that the interapertural surface is invariably cellulose in *Fistulipora* and solid in *Lichenalia*.

LICHENALIA SUBTRIGONA, Hall.

Lichenalia subtrigona, Hall. 1887. Pal. N. York, vol. VI., p. 196. Not figured.

Hamilton group, West Williams, Ontario. Hall.

LICHENALIA RAMOSA, Hall.

Lichenalia ramosa, Hall. 1887. Pal. N. York, vol. VI., p. 199.

"Hamilton group, West Williams, Ontario." Hall.

PINACOTRYPA ELEGANS, Rominger. (Sp.)

Fistulipora elegans, Rominger. 1866. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p 121.
Fistulipora proporoides, Nicholson. 1879. Struct. and Affin. Tabulate Corals of the Palæozoic Period, p. 310, fig. 41 (on p. 311) and pl. 15, figs. 2 and 2 *a*; teste Ulrich.
Pinacotrypa elegans, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII, p. 385.

Dr. Rominger's *Fistulipora elegans*, which Ulrich (*op. cit.*) makes the type of his genus *Pinacotrypa*, was based upon specimens from the shore of Lake Erie at Hamburg, N. Y., and from Widder. Two of the specimens from Hamburg have been presented to the Museum of the Survey by Dr. Rominger. According to Professor Nicholson (*op. cit.*) *F. proporoides* is common in the Hamilton Group at Canandaigua, in the State of New York.

HEDERELLA CIRRHOSA, Hall.

Hederella cirrhosa, Hall. 1881. Trans. Albany Inst., vol. X., p. 194.
" " " 1884. Rep. State Geol. for 1883, p. 53.
" " " 1887. Pal. N. York. vol. VI., p. 277, pl. 65, figs. 12 and 13.

Thedford, in the "Middle third of the section," C. Schuchert, 1895: six specimens, which have been identified with this species by Mr. Schuchert. They are all adherent to corals, five to as many specimens of *Heliophyllum Halli*, and one to a broken corallite of *Crepidophyllum Archiaci*. All six are No. 26,577 of the United States National Museum Catalogue of Invertebrate Fossils.

HEDERELLA MAGNA, Hall.

Hederella magna, Hall. 1881. Trans. Albany Inst., vol. X., p. 195.
„ „ „ 1884. Rep. State Geol. for 1883, p. 55.
„ „ „ 1887. Pal. N. York, vol. VI., p. 280, pl. 65, fig. 15.

Thedford, in the "Middle third of the section", C. Schuchert 1895: one specimen which was collected and determined by Mr. Schuchert. It is No. 26,576 of the United States National Museum Catalogue of Invertebrate Fossils.

BRACHIOPODA.

STROPHEODONTA PLICATA, Hall.

Strophodonta plicata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 90.
„ „ „ 1867. Pal. N. York, vol. IV., p. 114, pl. 63, figs. 30-32.
„ „ Whiteaves, 1889. This vol., pt. 2, p. 114.
„ „ Nettelroth, 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 149.
Comp. *Strophodonta (?) costata*, Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa, and Minn. p. 585, pl. 3, figs. 11 & 11 *a*; & pl. 3 A., fig. 5.
Comp. also *Tropidoleptus occidens*, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 91.
„ „ Hall. 1867. Pal. N. York, vol. IV., p. 408, pl. 61 A, figs. 50-52.
„ „ Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 82, figs. 37 & 38.

A few additional specimens of *S. plicata* have been obtained at Thedford by local collectors since 1889. It is highly probable, as suggested by Mr. Schuchert and as indicated in the foregoing synonymy, that *S. plicata* is the same shell as *S. costata*, Owen, and *Tropidoleptus occidens*, Hall. If so, the species now under consideration must of course be called *S. costata*, Owen, which was described in 1852, rather than *S. plicata*, or *T. occidens*, both of which were described eight years later. Owen's description and figures of *S. costata*, however, are very vague and unsatisfactory, being based upon a specimen only three-eighths of an inch in its greatest diameter, though it should not be forgotten that the original type of *S. plicata* is described as a "little more than half an inch in length," with the "length and width nearly equal."

PHOLIDOSTROPHIA IOWENSIS, Owen. (Sp.)

Chonetes (?) Iowensis, Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa and Minn., p. 584, pl. 3 A, fig. 7.
Strophomena (Strophodonta) nacrea, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 144.
Strophomena lepida, Hall. 1858. Geol. Rep. Iowa, vol. I., pt. 2, p. 493, pl. 3, figs. 3, *a-c*.
„ „ Billings. 1861. Journ. Canad. Inst., New Series, vol. VI., p. 344.
Strophodonta nacrea, Hall. 1867. Pal. N. York, vol. IV., p. 104, pl. 18, figs. 1 *a-k*.

Strophomena nacrea, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 68, and p. 69, fig. 21.
Stropheodonta (Pholidostrophia) nacrea, Hall and Clarke. 1892. Pal. N. York, vol. VIII., pt. 1, p. 287, pl. 15, figs. 20-24.
Pholidostrophia iowaensis, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 308.

According to Mr. Schuchert (*op. cit. supra.*) Owen's types of *Chonetes Iowensis*, "preserved in the United States National Museum prove to be identical with *Strophomena lepida*, which Hall in 1867 said is a synonym for *Stropheodonta nacrea.*"

ORTHOTHETES CHEMUNGENSIS, var. ARCTOSTRIATA, Hall.

Strophomena arctostriata, Hall. 1842. Geol. Rep. Fourth Distr. N. York, p. 266, fig. 2.
Orthisina arctostriata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 60.
Streptorhynchus chemungensis, var. *arctostriata*, Hall. 1867. Pal. N. York, vol. IV., p. 71, pl. 9, figs. 1-12.
Orthothetes chemungensis, var. *arctostriata*, Hall and Clarke. 1892. Pal. N. York, vol. VIII., pt. 1, pl. 10, fig. 8, and expl. of that plate.

Mr. Schuchert has identified with this variety of *O. Chemungensis* a few specimens which he collected in the "Upper and Lower third of the section" at Bartlett's Mills, in 1895, and since then similar specimens have been collected by Mr. Kernahan and Mr. Walker at the same locality.

ORTHOTHETES ANOMALUS, A. Winchell. (Sp.)

Crania (Pseudocrania) anomala, Winchell. 1866. Rep. Lower Penins. Mich., p. 92.
Pseudocrania anomala, Miller. 1889. N. Amer. Geol. and Palæont., p. 366.

Bartlett's Mills, in the "Middle third of the section," C. Schuchert, 1895: two specimens which were identified by Mr. Schuchert, and are No. 26,558 of the United States Museum Catalogue of Invertebrate Fossils.

CHONETES VICINA, Castelneau. (Sp.)

Leptæna vicina, Castelneau. 1843. Essai sur le Syst. Silur. de l'Amér. Septentr., p. 39.
Chonetes deflecta, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 149.
Chonetes gibbosa, Hall. 1857. Ibid. p. 145.
Chonetes deflecta, Hall. 1867. Pal. N. York, vol. IV., p. 126, pl. 21, figs. 7, 8.
Chonetes vicinus, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 180.

"Thedford and Bartlett's Mills, in the Lower third of the section," C. Schuchert, 1895: several specimens, identified by Mr. Schuchert and labelled No. 25,561, United States National Museum Catalogue of Invertebrate Fossils.

Although well preserved and almost perfect specimens of *Chonetes* are abundant in the shales of the Hamilton formation at Thedford and Bartlett's Mills, the number of species of that genus that is represented in these shales is still very doubtful. E. Billings, in his paper "on the Devonian fossils of Canada West," published in 1860, identifies *Chonetes* *hemisphærica*, Hall, as occurring in the Oriskany sandstone and Corniferous limestone of Ontario, but does not attempt to determine any of the species from the Hamilton formation of that province. Professor H. A. Nicholson, in his first "Report upon the Palæontology of the Province of Ontario," published in 1874, identifies *Chonetes lineata*, (Conrad not Vanuxem) *C. scitula*, Hall, and *C. lepida*, Hall, as occurring in the Hamilton formation of that province, but thinks that *C. lepida* may be the young of *C. scitula*. It seems doubtful, also, whether the distinction between the specimens from this formation, which Nicholson refers to *C. lineata* and *C. scitula*, can be maintained. In the second part of this volume, published in 1889, (p. 113) the writer identified a specimen from Bartlett's Mills with the *C. carinata* (or *coronata*) of Conrad, and similar specimens have since been collected at that locality. Mr. Schuchert informs the writer that the species which he found at Thedford and Bartlett's Mills are *C. scitula*, *C. coronata* and *C. vicina*.

CHONETES LINEATA (?) Conrad.

Chonetes lineata, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 73.
" " Calvin. 1888. Amer. Geologist, Vol. I., p. 83.

"Abundant in the Hamilton Formation of Bartlett's Mills, near Arkona, in the Township of Bosanquet," Nicholson. "Lower division of the Hamilton Group on the Rivière aux Sables." Calvin. See the remarks upon the preceding species.

STROPHALOSIA RADICANS, A. Winchell. (Sp.)

Crania radicans, A. Winchell. 1866. Rep. Lower Penins. Mich., p. 92.
Strophalosia radicans, Beecher. 1890. Am. Journ. Sc. and Arts, Ser. 3, vol. XL., p. 243, pl. 9, figs. 14-17.

Thedford, in the "Middle third of the section", C. Schuchert, 1895 : two attached valves, showing the slender processes radiating therefrom, and parasitic upon a badly preserved shell of a *Platyceras* or *Platyostoma*. Identified by Mr. Schuchert, and labelled United States National Museum Catalogue of Invertebrate Fossils, No. 26,565.

STROPHALOSIA TRUNCATA (?) Hall. (Sp.)

Productella (Strophalosia) truncata (Hall) Whiteaves. 1889. This vol., pt. 2, p. 112, pl. 16, figs. 1 and 2.

A few specimens of a little spinose *Strophalosia* from Thedford and Bartlett's Mills were identified with the *Productella truncata* of Hall, in the second part of this volume, on the authority of Professor R. P. Whitfield, who had kindly compared them with authentic examples of that species. Mr. Schuchert, however, in his MSS. list of fossils from these localities, makes the following remarks upon similar specimens collected by himself. "I believe this species to be distinct from *S. truncata.* It differs from *S. productoides* in that the dorsal valve is not spinose. *S. rockfordensis* has a lamellose dorsal valve and is different in shape."

ORTHIS (RHIPIDOMELLA) PENELOPE, Hall.

Orthis Penelope, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 79, figs. 1 and 2.
" " Hall. 1867. Pal. N. York, Vol. IV., p. 50, pl. 6, figs. 2, *a-m.*
" " " 1883. Second Ann. Rep., N.Y. St. Geologist, pl. 36, figs. 6-13.
Rhipidomella Penelope, Hall and Clarke. 1892. Pal. N. York, Vol. VIII., pt. I, pp. 211 and 225, pl. 6, figs. 6-13 ; and pl. 6 A, fig. 10 (?11).

Specimens of a large *Orthis* (or *Rhipidomella*), from Bartlett's Mills and Stony Point, Lake Huron, are identified by Mr. Schuchert with Hall's *O. Penelope*, but they appear to the writer to be merely adult or large examples of *O. Vanuxemi*, Hall. *O. Penelope* is probably only a synonym of *O. Vanuxemi*, and Mr. Schuchert admits that these two forms "appear to intergrade."

PENTAMERELLA PAVILIONENSIS (?) Hall.

Pentamerus papilionensis, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 86.
Pentameralla papilionensis, Hall. 1867. Pal. N. York, Vol. IV., p. 377, pl. 58, figs. 28-37.
Pentamerella pavilionensis, Hall and Clarke. 1893. Pal. N. York, Vol. VIII., pt. 2, p. 245, pl. 71, figs. 30 and 31.

Six specimens which are too small or too imperfect to be determined with much certainty, but which are probably referable to this species, have recently been collected at Thedford by Mr. Kernahan. Three of these have both valves more or less well preserved, the others being imperfect single valves, but none of them show any indication of a fold or sinus. The most perfect of these specimens, which is about ten millimetres and a half in length, and twelve mm. in breadth, has about eight subangular plications on each valve, which do not reach to the beak. In a larger but very imperfect ventral valve, the plications are more feebly marked and nearly marginal, and the length is apparently a little greater than the height. Some of these specimens are very similar to the shell which Owen figures on Plate 3 A, fig. 1, of the Illustrations to his "Report of a Geological Survey of Wisconsin, Iowa and Minnesota," which Mr. Schuchert identifies with *Pentamerella dubia*, Hall, but in that species the surface is said to be "marked by from fourteen to twenty or more plications."

GYPIDULA LÆVIUSCULA, Hall.

Gypidula læviuscula, Hall. 1867. Pal. N. York, vol. IV., p. 381, pl. 58, figs. 22 and 23.
" " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 248, pl 72, figs. 25 and 26.

Two specimens, which Mr. Schuchert says "differ somewhat from Iowa specimens of *G. læviuscula*" in having faint indications of plications along the middle of the anterior margin, were collected by him at Thedford, in the "Middle third of the section" in 1895. They are labelled, United States National Museum Catalogue of Invertebrate Fossils, No. 26,509. A few typical examples of this species have since been collected at the same locality by Mr. Kernahan.

CAMAROTŒCHIA SAPPHO, Hall.

Rhynchonella Sappho, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 87.
Rhynchonella (*Stenocisma*) *Sappho*, Hall. 1867. Pal. N. York, vol. IV., p. 340, pl. 54, figs. 33-43.
Rhynchonella Sappho, Herrick. 1888. Bull. Denison Univ., vol. III., p. 40, pl. 5, fig. 1; and pl. 7, fig. 25.
Camarotœchia Sappho, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p.192, pl. 57, figs. 10-14.

Thedford, in the "Middle third of the section," C. Schuchert, 1895: one crushed and distorted specimen, which is identified with this species by Mr. Schuchert. It is No. 26,564 of the Catalogue of Invertebrate Fossils in the United States National Museum.

CAMAROTŒCHIA HORSFORDI, Hall.

Rhynchonella Horsfordi, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 87.
Rhynchonella (*Stenocisma*) *Horsfordi*, Hall. 1867. Pal. N. York, vol. IV., p. 339, pl. 54, figs. 24-32.
Camarotœchia Horsfordi, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 192, pl. 57, figs. 7-9.

A few specimens of this shell have been collected at Thedford and Ravenswood by the Rev. Hector Currie, and at Thedford by Mr. Kernahan, but the species seems to have been first recognized in Canada by Mr. Schuchert.

CAMAROTŒCHIA THEDFORDENSIS. (Nom. prov.)

Plate 48, figs. 11, 11 *a* and 11 *b*.

Perhaps a diminutive stratigraphical variety of *Camarotœchia Billingsi*, Hall.

Cfr. *Rhynchonella Thalia*, Billings. 1860. Canad. Journ., vol. V., p. 272, figs. 23-25. But not *R. Thalia*, d'Orbigny, 1847.
" " " 1863. Geol. Canada, p. 370, fig. 386.
Rhynchonella (*Stenocisma*) *Billingsi*, Hall. 1867. Pal. N. York, vol. IV., p. 336, pl. 54, figs. 9-13.
Camarotœchia Billingsi, Hall and Clarke. 1893. *Ibid.*, vol. VIII., pt. 2, p. 192, pl. 57, fig. 3.

Shell very similar to the *C. Billingsi* of the Corniferous limestone in general shape and surface ornamentation, but differing therefrom persistently in its much more diminutive size, and more compressed valves. The largest specimens that the writer has seen are three collected at Thedford by the Rev. Hector Currie in 1882, which are of the following dimensions in millimetres. No 1, length 5, breadth 7; No. 2, length 6·5, breadth 6·25; No. 3, length 5·5, breadth 6. Average examples, which appear to be adult, are not quite so large. On the other hand, two of the largest examples of *C. Billingsi* in the Museum of the Survey measure, the one 8·25 mm. in length by 10·75 in breadth, and the other 8 mm. in length by 9·5 in breadth.

Abundant at Thedford, where specimens have been collected by the Rev. Hector Currie, Mr. Kernahan, Mr. Kearney, Mr. Macintosh and Mr. Schuchert.

In a previous list of the fossils of this formation the three specimens collected by Mr. Currie in 1882 were regarded as a small form of *C. Billingsi*, but the subsequent examination and study of more than a hundred and fifty specimens has thrown considerable doubt on the correctness of this conclusion. Under the circumstances it seems desirable to distinguish these little shells by a local and provisional name, as they seem to bear about the same relation to the typical *C. Billingsi* that it does to *C. Horsfordi*, or that *C. Tethys* does to *C. Sappho*.

LEIORHYNCHUS IRIS? Hall.

Cfr. *Leiorhynchus iris*, Hall. 1867. Pal. N. York, vol. IV., p. 360, pl. 56, figs. 41-43.

In 1895, Mr. Schuchert collected, at Thedford, a somewhat imperfect specimen of a small rhynchonelloid shell, which he refers to this species, but with some doubt. This specimen is No. 26,504 of the United States National Museum Catalogue of Invertebrate Fossils, and two similar but more perfect specimens have since been collected by Mr. Kernahan at the same locality. On the ventral valve of each of these specimens there are two distinct longitudinal subangular plications in the sinus and two on each side or six in all, and on the dorsal three well marked plications on the mesial fold and two fainter ones on each side, or seven in all. None of these plications extend quite to the beak. Hall's description of *L. iris* does not give the number of plications on either valve, but, if his figures of that species are correct, there would appear to be ten or twelve plications on the ventral valve and ten on the dorsal.

PUGNAX KERNAHANI. (N. Sp.)

Shell very small for the genus, varying in marginal outline from subovate and a little longer than wide, to subpentagonal or nearly circular and as wide or a little wider than long, strongly convex, some specimens being higher or deeper than broad, most prominent on the dorsal side anteriorly, subtrigonal in a full edge view, and truncated in front.

Ventral valve shallower than the dorsal, regularly convex in the umbonal region and for about one half its length, but impressed anteriorly with a rather short mesial sinus which is bounded on each side by a short subangular ridge. At the front margin of this valve the mesial portion is prolonged and bent abruptly inward, and the lateral portions are minutely serrate or denticulate, there being apparently three minute denticles on each side of the sinus. Beak of the ventral prominent, acute, and but slightly incurved, the deltidium apparently longer (or higher) than wide.

Dorsal valve faintly plicated in the median line anteriorly, the fold being longitudinally depressed in the middle and bounded on each side by a short subangular longitudinal groove, which widens outward and is followed by a short subangular lateral plication.

In addition to the coarser markings already described, the surface is ornamented with fine lines of growth which are too small to be visible without the aid of a lens. Over most of the surface, they are comparatively few and distant, but close to the anterior margin they are very numerous and densely crowded.

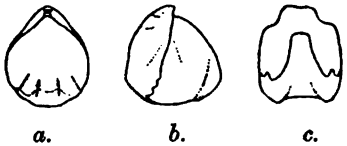

FIG. 3. *Pugnax Kernahani.* *a*, Dorsal view,—*b*, edge view,—and *c*, front view, of an adult specimen, in outline and of twice the natural size.

Characters of the interior of the valves unknown.

Dimensions of the largest specimen known to the writer: maximum length 6·5 mm.; greatest breath, 5·4 mm.; maximum height or depth, 6·1 mm.

A few specimens of this small and evidently very distinct ribless species have recently been collected at Thedford by Mr. Kernahan and Mr. Macintosh, who have kindly presented three to the Museum of the Survey, and by Mr. Schuchert.

CYCLORHINA NOBILIS, Hall.

Rhynchospira nobilis, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 83.
Trematospira ? nobilis, Hall. 1867. Pal. N. York, vol. IV., p. 412, pl. 63, figs. 33—36.
Retzia (Trematospira) nobilis, Whiteaves. 1887. This volume, (advance sheets), p. 116.
Cyclorhina nobilis, Hall and Clarke. 1893. Pal. N. York., vol. VIII, pt. 2, p. 207, pl. 61, figs. 1—12.

This fine species, which is not uncommon in the neighbourhood of Thedford, is the type of Hall and Clarke's genus *Cyclorhina*, published in 1893.

EUNELLA HARMONIA, Hall.

Terebratula harmonia, Hall. 1867. Pal. N. York, vol. IV., p. 388, pl. 60, figs. 11—16.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 154, pl. 17, figs. 1—4.
Eunella harmonia, Hall and Clarke. 1893. Pal. N. York, vol. VIII, pt. 2, p. 290, pl. 80, figs. 33—35.

" Middle third of the section at Bartlett's Mills," C. Schuchert, 1895 : three specimens which Mr. Schuchert identifies with this species, and which the writer has had the opportunity of studying.

EUNELLA SIMULATOR, Hall.

Terebratula simulator, Hall. 1867. Pal. N. York, vol. IV., p. 391, pl. 60, figs. 69—70.
Eunella simulator, Hall. 1893. Rep. St. Geol. N. York, vol. II., p. 862, fig. 496; and pl. 52, fig. 29; also fig. 24 of expl. of that plate.
Terebratula (Eunella) simulator, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 290, fig. 209.
Eunella simulator, Hall and Clarke. 1894. Ib., pl. 80, fig. 27, and expl. of that plate.

The original description and figures of this species were based upon a "specimen received from Dr. Rominger, collected in the Hamilton group at Widder, Canada West," or, as it is now called, at Thedford, Ontario. *E. simulator* would seem to be quite a rare shell, as it has not been recognized by the writer in any of the Survey collections, nor in any of the local collections at Thedford, and Mr. Schuchert did not find it at that locality nor at Bartlett's Mills.

EUNELLA ATTENUATA. (N. Sp.)

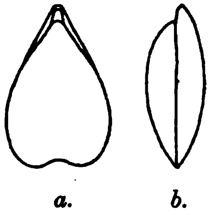

Fig. 4. *Eunella attenuata*. *a*, Dorsal, and *b*, edge view, of an adult specimen, in outline and of twice the natural size.

Shell elongated, compressed, the maximum thickness through the closed valves being little more than one half of their greatest breadth, narrowly subovate, longer than broad and broadest in advance of the midlength, but concavely and shallowly emarginate in the middle in front (when adult), and attenuate behind, the marginal outline being quite petaloidal.

Ventral valve with a straight, erect slender beak, which is subangular on each side, its apex truncated and perforated, its deltidial area narrow and bounded by two slightly divergent lines. Dorsal valve a little shorter posteriorly than the ventral, with a slightly smaller and entire incurved beak.

Surface practically smooth, though concentric lines of growth are visible in some specimens when examined with a lens: shell structure minutely punctate. Characters of the interior of the valves unknown.

Dimensions of an apparently adult specimen: maximum length, 10·8 mm.; greatest breadth, 7·0 mm.; maximum thickness, 3·8 mm.

Apparently not very uncommon at Thedford and Bartlett's Mills, in the "Middle third of the section." Specimens in the Museum of the Survey were collected at one or other of these localities by the Rev. Hector Currie and Rev. J. M. Goodwillie in 1882, and by Mr. Kernahan in 1896. The writer is informed by Mr. Schuchert that he has seventeen specimens of this species from these localities.

CRANÆNA ROMINGERI, Hall.

Terebratula Romingeri, Hall. 1863. Sixteenth Rep. N. York St. Cab. Nat. Hist., p. 48, figs. 22 & 23.
Terebratula Romingeri, Hall. 1867. Pal. N. York, vol. IV., p. 389, pl. 60, figs. 17-25, 66 & 67.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 155, pl. 16, figs. 20-22.
Cranæna Romingeri, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 297, fig. 215; and pl. 80, figs. 13-19.

Same horizon and localities as for the last species. It seems to be rather abundant at Thedford, where it was first recognized by Mr. Schuchert.

TROPIDOLEPTUS CARINATUS, Conrad. (Sp.)

Strophomena carinata, Conrad. 1839. Third Ann. Rep. N. York Geol. Surv., p. 64.
Tropidoleptus carinatus, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 151, figs. 1 & 2: & (1859) Twelfth do., p. 31, figs. 1-4.
" " Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, fig. 672.
" " Hall. 1867. Pal. N. York, vol. IV., p. 407, pl. 62, figs. 2 & 3.
" " Meek and Worthen. 1868. Geol. Surv. Illinois, vol. III, p. 427, pl. 13, fig. 2.
" " Rathbun. 1874. Bull. Buffalo Soc. Nat. Sc., 1, p. 254, pl. 9, figs. 1, 9, 10, 26.

Tropidoleptus carinatus, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 146, pl. 17, figs. 14 & 15.
" " A. Ulrich. 1892. Neues Jahrb. fur Min., Geol., and Palæont, Beilageband, VIII., p. 73, pl. 4, figs. 32-34.
" " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 304, figs. 227 and 228; and pl. 82, figs. 26-36.

A few specimens of this widely distributed brachiopod have recently been collected at Thedford. They are rather similar in shape and sculpture to *Stropheodonta plicata*, which occurs at the same locality and geological horizon, but the latter shell has a long and transversely striated cardinal area and its test is impunctate.

ATRYPA SPINOSA, Hall.

Atrypa spinosa, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 200, figs. 1 and 2.
Atrypa dumosa, Hall. 1843. Ibid., p. 271, fig. 1.
Atrypa aspera, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 168.
" " Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, figs. 671.
Atrypa spinosa, vel *aspera*, Hall. 1867. Pal. N. York, vol. IV., p. 322, pl. 53 A, figs. 1-14, 18, 24 and 25.
Atrypa aspera, Meek. 1868. Trans. Chicago Ac. Sc., vol. I., p. 96, pl. 13, fig. 12.
Atrypa spinosa, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 80.
" " Whitfield. 1882. Geol. Wiscons., vol. IV., p. 333, pl. 26, figs. 7 and 8.
Atrypa aspera, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 88, pl. 14, figs. 1-11.
Atrypa reticularis, var. *aspera*, Whiteaves. 1891. This vol., pt. 3, p. 229; and (1892) pt. 4, p. 289.
Atrypa spinosa, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 55, figs. 21 and 22.
" " Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 156.

A shell which Mr. Billings calls a coarse-ribbed variety of *Atrypa reticularis* is figured as one of the characteristic fossils of the Hamilton formation of Ontario, on page 384 of the "Geology of Canada" (1863), and a single specimen, collected at Thedford by Mr. R. Macintosh in 1895, has been identified with the *A. spinosa* of Hall by Mr. Schuchert. In two previous parts of this volume *A. spinosa* was regarded as synonymous with the *Atrypa reticularis*, var. *aspera* of European palæontologists, but as *A. spinosa* is still regarded as a valid species, the writer has thought it better to retain that name for the present and to give only American references. Thus, the Rev. G. F. Whidborne, in the third part of the second volume of his Monograph of the Devonian Fauna of the South of England, published by the Palæontographical Society in 1893, makes the following remark in reference to *Atrypa aspera* (Schlotheim). "*Atrypa spinosa*, Hall, *A. hystrix*, Hall, and *A. aspera*, v. *occidentalis*, Hall, do not seem to me to be identical with this species, but closely allied." Professors Hall and Clarke, also, in 1895, in their explanation of Plate 55 of the second part of the eighth volume of the Palæontology of New York, retain the name *Atrypa spinosa* for specimens from the Hamilton formation of that state, though, on page 172 of the same volume they expressly state that "the *A. spinosa* of the Hamilton shales is but an *A. aspera* with the lamellæ enfolded into tubular spines."

SPIRIFERA PENNATA, Atwater. (Sp.)

Terebratula pennata, Atwater. 1820. Am. Journ. Sc. and Arts, vol. II., p. 244, pl. 1, figs. 2 and 3.
Delthyris mucronata, Conrad. 1841. Fifth Ann. Rep. Geol. Surv. N. York, p. 54.
" " Vanuxem. 1842. Geol. N. York, Rep. Third Distr., p. 150, fig. 3.
" " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 198, figs. 2, 3; p. 205, fig. 3, (non p. 270, fig. 3).
" " Hall. 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., pl. 11, fig. 18.
Spirifer mucronata, Billings. 1856. Canad. Nat. and Geol., vol. I., p. 474, pl. 7, figs. 9 and 10.
Spirifera mucronata, Billings. 1861. Canad. Journ., N.S., vol. VI., p. 254, figs. 59-62.
" " " 1863. Geol. Canada, p. 386, figs. 424, *a-d*.
" " Hall. 1867. Pal. N. York, vol. IV., p. 216, pl. 34, figs. 1-32; and of numerous subsequent American palæontologists.

The law of priority would seem to require the adoption of the specific name proposed by Atwater for this well-known fossil, in 1820, as suggested by Dr. S. A. Miller.

SPIRIFERA EURYTEINES, Owen.

Delthyris euruteines, Owen. 1844. Rep. Geol. Expl. Iowa, Wiscons. and Ill., p. 69, pl. 12, fig. 9.
Spirifer euruteines, Owen. 1852. Geol. Surv. Wiscons., Iowa and Minn., p. 586, pl. 3, figs. 2 and 6.
Spirifer parryana, Hall. 1858. Geol. Surv. Iowa, vol. I., pt. 2, p. 509, pl. 4. fig. 8.
Spirifer capax, Hall. 1858. *Ibid.*, p. 520, pl. 7, fig. 7.
Spirifera Parryana, Billings. 1861. Canad. Journ., vol. VI, p. 261, figs. 77 and 78.
" " " 1863. Geol. Canada, p. 386, fig. 422.
Spirifera fornacula, Meek and Worthen (non Hall), 1868. Geol. Surv. Ill., vol. III., p. 433, pl. 13, fig. 8.
Spirifera Parryana, Hall. 1883. Second Ann. Rep. N. Y. St. Geologist, pl. 52, figs. 8 and 9.
Spirifera capax, Hall. 1883. *Ibid.*, pl. 52, figs. 15-17.
? *Spirifera Parryana*, Walcott. 1884. Palæont. Eureka Distr. Nevada, p. 137, pl. 14, fig. 10.
Spirifera Parryana, Calvin. 1888. Bull. Lab. St. Univ. Iowa, p. 19.
Spirifer Parryanus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 29, 31, 39, pl. 22, figs. 8, 9, 15-17.
Spirifer euryteines, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 389.

E. Billings says (*op. cit.*, 1861) that a single specimen of *S. Parryana* was collected by Mr. C. Robb in the Hamilton shales at Lowe's Mill, Township of Bosanquet, but no other specimens of that species have been found, so far as the writer is aware, by any local collector in the Hamilton formation of Ontario. In the Museum of the Survey there are two specimens labelled with the name of this species, and as having been collected by Mr. Robb near Thedford, but it is doubtful whether either of them is the specimen figured by Mr. Billings. One of them has the surface so much worn that the finer surface markings are obliterated, and the other looks as if it had been treated with acid. Either of them might as well be referred to *Spirifera granulosa* (Conrad) as to *S. Parryana.*

SPIRIFERA AUDACULA, Conrad. (Sp.)

Delthyris audacula, Conrad. 1842. Journ. Ac. Nat. Sc. Philad., vol. VIII., p. 262.
Delthyris medialis, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 208, fig. 8.
Spirifer Eatoni, Hall. 1857. Tenth Rep. N.Y. St. Cab. Nat. Hist., p. 157.
Spirifer medialis, Hall. 1857. *Ibid.*, p. 164, fig. 1.
Delthyris medialis, Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, fig. 669.
Spirifera medialis, Hall. 1867. Pal. N. York, vol. IV., p. 227, pl. 38, figs. 1-25.
Spirifera medialis, var. *Eatoni*, Hall. 1867. *Ibid.*, pl. 38, figs. 12-18.
Spirifera audacula, Whitfield. 1882. Geol. Wiscons., vol. IV., p. 329, pl. 25, figs. 25 and 26.
Spirifera medialis, Hall. 1883. Second Ann. Rep. N.Y. St. Geologist, pl. 54, figs. 1-13.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 125, pl. 26, figs. 2-5.
Spirifer audaculus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 29, 30 and 31, pl. 24, figs. 1-13; and pl. 29, fig. 5.

Two large ventral valves, which appear to be referable to this species, were collected at Bartlett's Mills by Dr. H. M. Ami in 1883, and more recently, two small but perfect specimens of the same shell have been collected at Thedford, one by the Rev. Hector Currie and the other by Mr. Kernahan.

SPIRIFERA DIVARICATA, Hall.

Spirifer divaricata, Hall. 1857. Tenth Rep. N.Y. St. Cab. Nat. Hist., p. 133.
Spirifera divaricata, Hall. 1867. Pal. N. York, vol. IV., p. 213, pl. 32, figs. 1-6.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 113, pl. 11, figs. 6-11; pl. 12, figs. 5-11.
Spirifer divaricatus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 24, 27, 39, pl. 38, figs. 15-17.

Thedford, G. Kernahan, 1897: one large and characteristic specimen which he has kindly presented to the Museum of the Survey.

DELTHYRIS CONSOBRINA, d'Orbigny. (Sp.)

Delthyris ziczac, Hall (non Roemer). 1843. Geol. N.Y., Rep. Fourth Distr., p. 200, fig.
Spirifera consobrina, d'Orbigny. 1850. Prodr. Paléont., vol I., p. 98.
Spirifera ziczac, Hall. 1867. Pal. N. York, vol. IV., p. 222, pl. 35, figs. 15-23.

Spiriferina ? ziczac, Whitfield. 1882. Geol. Wiscons., vol. IV., p. 332, pl. 25, figs. 23 and 24.
Spirifera ziczac, Hall. 1883. Second Ann. Rep. N. York St. Geologist, pl. 59, fig. 9 and pl. 60, fig. 18.
Spirifera consobrina, Miller. 1889. N. Amer. Geol. and Palæont, p. 372.
Spirifera ziczac, Whitfield. 1891. Annals N. York Acad. Sc., vol. V., p. 554, pl. 11, fig. 13.
" " " 1895. Geol. Ohio, vol. VII., p. 448, pl. 7, fig. 13.
Spirifer consobrinus, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 34, figs. 9-18 ; and pl. 37, figs. 9 and 10.
Delthyris consobrina, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 206.

A few specimens of this shell were collected at Thedford, in the "Middle third of the section," by Mr. Schuchert and Mr. Kernahan in 1895, but the species was first recognized at this locality by Mr. Schuchert.

RETICULARIA FIMBRIATA, Conrad. (Sp.)

Delthyris fimbriatus, Conrad. 1842. Journ. Acad. Nat. Sc. Philad., vol. VIII., p. 263.
" " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 208, fig. 10.
Spirifer fimbriatus, Hall. 1858. Geol. Surv. Iowa, vol. I., pt. 2, p. 505, pl. 4, fig. 5.
" " Billings. 1861. Canad. Journ., vol. VI., p. 257, figs. 68-70.
" " " 1863. Geol. Canada, p. 372, fig. 393.
Spirifera fimbriata, Hall. 1867. Pal. N. York, vol. IV., p. 214, pl. 33, figs. 1-11.
Spirifer compactus, Meek. 1868. Trans. Chicago Acad. Sc., vol. I, p. 102, pl. 14, fig. 11.
Spirifer (*Martinia*) *Richardsoni*, Meek. 1868. *Ibid.*, p. 104, pl. 14, fig. 2.
Spirifera fimbriata, Hall. 1883. Second Ann. Rep. N. Y. St. Geol.,pl. 61, figs. 17-22.
Spirifera Conradana, S. A. Miller. 1883. Am. Palæoz. Foss., 2nd. Ed., p. 372.
Spirifera (Martinia) undifera, Walcott. 1884. Mon. U.S. Geol. Surv., vol. VIII., pl. 3, figs. 3-6 ; and pl. 14, fig. 11.
Spirifera Conradana, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 110, pl. 7, figs. 11-13.
Spirifera (M.) Richardsoni, Whiteaves. 1891. This volume, pt. 3, p. 226; and (1892) pt. 4, p. 287, pl. 37, fig. 7.
Spirifera fimbriata, Whiteaves. 1892. This volume, pt. 4, p. 286.
Spirifer fimbriatus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 17, 20, 21, 33 and 37, pl. 36, figs. 17-22 ; and pl. 38, figs. 9 and 10.
Reticularia fimbriata (Conrad) Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 342.

With the exception of the last reference, the foregoing list of synonyms, with references, though differently arranged, is quoted from Mr. Schuchert's excellent and most useful "Synopsis of American Fossil Brachiopoda," published as "Bulletin of the United States Geological Survey, No. 87." On page 342 of that publication, the following observations are made on *R. fimbriata*: "Mr. Walcott is correct in regarding this species the same as *Spirifer undiferus*, Roemer. Conrad's species, however, was published in 1842, while that of Roemer is two years later, or in 1844. *S. Richardsoni* is a young specimen of *S. compacta*, which Mr. Walcott has shown to be a synonym for *S. undiferus*."

ATHYRIS SPIRIFEROIDES, Eaton. (Sp)

Terebratula spiriferoides, Eaton. 1831. Am. Journ. Sc. and Arts, vol. XXI., p. 137.
" " " 1832. Geological Text-book, p. 46.
Atrypa concentrica, Conrad. 1838. Ann. Rep. Geol. Surv. New York, p. 111.
" " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 198, fig. 5.
Spirifera spiriferoides, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 153, figs. 1 and 2.
Athyris spiriferoides, Hall. 1860. Thirteenth do., p. 93, figs. 1-4.
Spirigera concentrica, Billings. 1861. Canad. Journ., vol. VI., p. 145, figs. 54 and 55; and p. 146, figs. 56 and 57.
Athyris spiriferoides, Hall. 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 180, figs. 1-4.
Spirigera concentrica, Billings. 1863. Geol. Canada, p. 373, fig. 379; and p. 385, figs. 421, *a-c*.
Athyris spiriferoides, Hall. 1867. Pal. N. York, vol. IV., p. 285, pl. 46, figs. 5-31.
Spirigera spiriferoides, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 85.
Athyris spiriferoides, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 89, figs. 60 and 61; and pl. 45, figs. 11-27.

The common *Athyris* or *Meristella* of the Hamilton shales of Ontario was identified with the *A. concentrica* of European authors in 1861 by E. Billings, who called it *Spirigera concentrica.* In 1867 Professor Hall identified Canadian specimens of the same shell with *A. spiriferoides.* Mr. Billings was under the impression that *A. concentrica* was described by Bronn, in 1829, under the name *Terebratula concentrica*, in accordance with the statement made by Bronn himself on page 1233 of the second volume of his "Index Palæontologicus." Davidson, however, in the synonymy of that species in his monograph of British Devonian Brachiopoda, says that *Terebratula concentrica* was first described by Von Buch in 1839, and definitely accepts that year as the date of its publication. If Davidson's conclusion is correct, it follows that, whether the American fossil be identical with the European species or not, the name *A. spiriferoides* has eight years priority of date over *A. concentrica.* Mr. Schuchert thinks that all the small specimens from Thedford and Bartlett's Mills should be referred to *Athyris Fultonensis*, Swallow (= *A. vittata*, Hall) and that only the larger ones are *A. spiriferoides.* Professor Hall says that the spires or spiral coils of the interior of *A. vittata* are quite distinct from those of *A. spiriferoides*, but the writer has never seen any specimen of an *Athyris* from Thedford or Bartlett's Mills in which any portion of the internal spires is visible.

ATHYRIS FULTONENSIS, Swallow. (Sp.)

Spirigera fultonensis, Swallow. 1860. Trans. St. Louis Ac. Sc., vol. I., p. 650.
Spirigera minima, Swallow. 1860. *Ibid.*, p. 649.
Athyris vittata, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 89.
Spirigera eborea, A. Winchell. 1866. Rep. Lower Peninsula Michigan, p. 94.

Athyris vittata, Hall. 1867. Pal. N. York, vol. IV., p. 289, pl. 46, figs. 1-4.
" " White. 1880. Second Ann. Rep. Indiana Bur. Statist. and Geol., p. 502, pl. 4, figs. 8 and 9.
" " White. 1881. Tenth Rep. St. Geol. Indiana, p. 134, pl. 4, figs. 8 and 9.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 87, pl. 16, figs. 25-32.
" " Whiteaves. 1892. This volume, pt. 4, p. 228.
" " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 90, figs. 62 and 63 ; pl. 45, figs. 1-5.
" " Keyes. 1895. Geol. Surv. Missouri, vol. V., p. 90, pl. 41, fig. 1.

See the remarks on the preceding species.

MERISTELLA BARRISII, Hall.

Meristella Barrisi, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 84.
" " 1867. Pal. N. York, vol. IV., p. 304, pl. 49, figs. 5-22.
" Hall and Clarke. 1895. *Ibid.*, vol. VIII., pt. 2, pl. 43, figs. 25 and
" 26; and pl. 44, figs. 27-30.

Thedford, G. Kernahan, 1894-97: an unusually large but somewhat imperfect specimen which has been identified with this species by Mr. Schuchert.

PENTAGONIA UNISULCATA, Conrad. (Sp.)

Atrypa unisulcata, Conrad. 1841. Fifth Ann. Rep. Geol. Surv. N. York, p. 56.
Pentagonia Peersii, Cozzens. 1846. Ann. Lyc. Nat. Hist. N. York, vol. IV., p. 158, pl. 10, fig. 3.
Rhynchonella unisulcata, Hall. 1857. Tenth Rep. N.Y. St. Cab. Nat. Hist., p. 125.
Athyris? unisulcata, Billings. 1860. Canad. Journ., vol. V., p. 279, figs. 39-42.
Goniocœlia uniangulata, Hall. 1861. Fourteenth Rep. N. Y. St. Cab. Nat. Hist., p. 101.
Atrypa unisulcata, Hall. 1862. Fifteenth do., pl. 11, fig. 10.
Meristella ? unisulcata, Hall. 1862. *Ibid.*, pl. 2, figs. 17-25.
Athyris unisulcata, Billings. 1863. Geol. Canada, p. 373, fig. 396.
Meristella (*Pentagonia*) *unisulcata*, vars. *biplicata* and *uniplicata*, Hall. 1867. Pal. N. York, vol. IV., p. 309, pl. 50, figs. 18-35.
Meristella unisulcata, Whiteaves. 1887. This volume, part 2, p. 115.
" *unisulcata*, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 99, pl. 15, figs. 9-16.
Pentagonia unisulcata, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, p. 80, pl. 42, figs. 22-32.
" " Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 302. (From which this list of synonyms and references is quoted.)

This species appears to be of rather rare occurrence in the Hamilton and Corniferous formations of Ontario. One specimen of the var. *biplicata* in the Museum of the Survey, is from the Corniferous limestone of Haldimand Co., Ont., where it was collected by Mr. De Cew in 1857.

MOLLUSCA.

PELECYPODA.

ACTINOPTERIA BOYDII, Conrad. (Sp.)

For the synonymy of this species, with references, see part 3 of this volume, p. 239.

A few detached valves of *A. Boydii* were collected by the writer in 1891 on the banks of the Rivière aux Sables at Bartlett's Mills and at Hill No. 4, near Thedford. Similar specimens were obtained by Mr. Schuchert in 1895 at Bartlett's Mills.

LEIOPTERIA RAFINESQUII, Hall.

Leiopteria Rafinesquii, Hall. 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations, pl. 15, fig. 11; and pl. 20, figs. 6 and 7.
" " " 1884. Pal. N. York, vol. V., pt. 1, Lamellibr., II, p. 161, pl. 15, fig. 11; pl. 20, figs. 6 and 7; and pl. 88, figs. 27 and 28.

A few years ago the writer was informed by Professor Calvin that he had found a specimen of *L. Rafinesquii* in the Thedford region, and Mr. Schuchert writes that he collected a specimen, which he identifies with this species, in the "Upper third of the section" at Bartlett's Mills. The only *Leiopteria* from the Hamilton formation of Ontario that the writer has seen is a left valve, with only a portion of the posterior wing preserved, from Bartlett's Mills, in the collection of the Rev. Hector Currie, and it looks quite as much like *L. Dekayi*, Hall, as *L. Rafinesquii*.

LIMOPTERA MACROPTERA, Conrad. (Sp.)

Lima macroptera, Conrad. 1838. Ann. Rep. N. York Geol. Surv., p. 117.
Limoptera macroptera, Hall. 1869. Prelim. Notice Lamellibr. Shells, &c., pt. 2, p. 17.
" " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 24, fig. 14; pl. 26, figs. 6-9; pl. 27, figs. 1-10; pl. 28, figs. 4 and 5; and pl. 29, figs. 1-4.
" " " 1884. *Ibid.*, p. 246, plates as in last reference, but add pl. 92, figs. 4-9.

Mr. Schuchert collected a cast of the interior of an aviculoid shell, which he identifies with this species, in the "Middle third of the section," at Bartlett's Mills in 1895. This specimen, which the writer has examined, is No. 26,492 of the United States National Museum Catalogue of Invertebrate Fossils.

CYPRICARDELLA BELLISTRIATA ? Conrad.

For a list of the synonyms of this species, with references, see page 308 of this volume.

Three casts of the interior of small shells, which are probably young or small individuals of this species, have recently been collected at Bartlett's

Mills by the Rev. Hector Currie, who has kindly presented two of them to the Museum of the Survey. The maximum length of the largest of the three is only twenty-seven millimetres, and it is not quite certain that they are not very young examples of *C. tenuistriata* (Hall).

A well preserved but rather imperfect specimen of *C. bellistriata*, in the Museum of the Survey, is labelled as having been collected by J. De Cew in 1857 from the Corniferous limestone of Lot 24, Concession 1, Walpole, Ontario.

NUCULA LIRATA, Conrad.

A list of the synonyms of this species is given on page 301.

An imperfect and badly preserved cast of the interior of the closed valves of a small shell which Mr. Schuchert identifies with *N. lirata*, was collected by him at Bartlett's Mills (in the "Lower third of the section") in 1895. The specimen is No. 26,496 of the United States National Museum Catalogue of Invertebrate Fossils.

The "badly preserved single valves" from the north side of Manitoba Island referred to under the name *N. lirata*, on page 301 of the fourth part of this volume, may not belong to the same species nor even to the same genus.

NUCULITES TRIQUETER, Conrad.

Nuculites triqueter, Conrad. 1841. Ann. Rep. Geol. Surv. N. York, p. 50.
" " Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2. p. 4.
" " Hall. 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 47, figs. 17-24.
" " Hall. 1885. Ibid., vol. V., pt. 1, Lamellibr. 2, p. 326, pl. 47, figs. 17-24; and pl. 93, figs. 8-10.

Bartlett's Mills, in the "Lower third of the section", three small but well preserved casts of the interior of the shell, which were collected in 1895, by Mr. Schuchert, who identifies them with this species. The largest is scarcely four millimetres in its maximum length, but in all three the "impression of the curved muscular ridge or clavicle just anterior to the beaks," which is so characteristic of the genus, is remarkably well defined. The specimens are No. 26,498 of the United States National Museum Catalogue of Invertebrate Fossils.

LEDA ROSTELLATA, Conrad. (Sp.)

Nuculites rostellata, Conrad. 1841. Geol. Surv. N. York, Ann. Rep., p. 50.
Leda? rostellata, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 5.
Leda (*Nuculana*) *rostellata*, Hall. 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 47, figs. 45-47.

Leda (*Nuculana*) *perstriata*, Hall. 1883. *Ibid.*, pl. 47, figs. 42-44.
Leda rostellata, Hall. 1885. Pal. N. York, vol. V., pt. 1, Lamellibr., 2, p. 330, pl. 47, figs. 42-47.

A few casts of the interior of both valves of a *Leda*, which are so essentially similar to *L. rostellata* in marginal outline and in the size and position of the beaks that they are probably referable to that species, have been collected of late years at Bartlett's Mills by Mr. Kernahan, Mr. Kearney and Mr. Schuchert. Two of these casts are in the Museum of the Survey.

PALÆONEILO PLANA, Hall.

Palæoneilo plana, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 7.
" " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 48, figs. 21-28.
" " " 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 334, pl. 48, figs. 21-28.

Bartlett's Mills, in the "Lower third of the section," a single specimen (a cast of the interior of the closed valves about nine millimetres in length) which was collected and identified by Mr. Schuchert. This little cast is No. 26,499 of the United States National Museum Catalogue of Invertebrate Fossils.

NYASSA ARGUTA, Hall.

Nyassa arguta, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 28.
" " " 1883. Pal N York, vol. V., pt. 1, Plates and Explanations: pl 53, figs. 9-20.
" " " 1885. Ibid., vol. V., pt. 1, Lamellibr. 2, p. 354, pl. 53, figs. 7-20.

A single specimen, which agrees very well with the description and figures of this species, but which does not show any of the characters of the hinge dentition, was collected at Thedford by Mr. B. E. Walker, of Toronto, in 1896.

PARACYCLAS LIRATA, Conrad. (Sp.)

Posidonia lirata, Conrad. 1838. Rep. Geol. Surv. N. York, p. 116, pl. (no number) fig. 12.
Lucina (*Paracyclas*) *lirata*, Hall and Whitfield. 1872. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 200.
Paracyclas lirata, Hall. (Pars.) 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 72, figs. 1-19.
Paracyclas lirata, Hall. 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 441, pl. 72, figs. 1-19; and pl. 95, fig. 19.

Apparently not very uncommon at Bartlett's Mills, where specimens have been collected during the last two or three years by Mr. Kernahan, Mr. Kearney and Mr. Schuchert.

ORTHONOTA PARVULA, Hall.

Orthonota parvula, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 88.
" " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 78, figs. 29-32.
Sanguinolites truncatus, Hall. (Pars.) 1883. *Ibid.*, vol. V., pt. 1, Plates and Explanations: pl. 65, figs. 1-6.
Orthonota? parvula, Hall. 1885. *Ibid.*, vol. V., pt 1, Lamellibr. 2, p. 482, pl. 65, figs. 2 and 3; and pl. 78, figs. 29-32.

Bartlett's Mills (in the "Lower third of the section"), C. Schuchert, 1895: a beautifully preserved but very small specimen, not more than four millimetres in its maximum length, which Mr. Schuchert identifies with this species. The specimen is No. 26,501 of the United States National Museum Catalogue of Invertebrate Fossils.

GASTEROPODA.

PLATYOSTOMA TURBINATUM, Hall.

Platyostoma turbinata, Hall. 1861. Fourteenth Rep. N. Y. St. Cab. Nat. Hist., p. 106
" " " 1876. Illustr. Devonian Fossils: Gasteropoda, pl. 10.
" " " 1879. Pal. N. York, vol. V., pt. 2, p. 27, pl. 9, figs. 12-24.

Mr. Schuchert refers to this species six specimens of a shell collected by Mr. Macintosh and himself at Bartlett's Mills (in the "Lower third of the section") in 1895. These specimens, which the writer has examined and which are No. 26,483 of the United States National Museum Catalogue of Invertebrate Fossils, seem to be intermediate in their characters between *P. turbinatum* and *P. lineatum*.

Since the publication of Hall's "Illustrations of Devonian Fossils" it has became obvious that the fossil from the Corniferous limestone of Port Colborne that Nicholson had previously described and figured (in 1874) under the name "*Helicotoma? serotina*," is most probably a cast of the interior of the shell of a specimen of *P. turbinatum*. In the Museum of the Survey there are a few characteristic examples of the typical form of *P. turbinatum*, collected by J. De Cew in 1857, from the Corniferous limestone of Rama's Farm, near Port Colborne, and of Lot 4, Concession 3, Township of Bertie.

PLEUROTOMARIA CAPILLARIA, Conrad.

Pleurotomaria capillaria, Conrad. 1842. Journ. Acad. Nat. Sc. Philad., vol. VIII., p. 271, pl. 16, fig. 11.
" " Hall. 1861. New Species of Devon. Fossils, &c., p. 17.
" " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 4-5, pl. 5, fig. 2.
" " Hall. 1876. Illustr. Devonian Fossils: Gasteropoda, pl. 20,
" " " 1879. Pal. N. York, vol. V., pt. 2, p. 77, pl. 20, figs. 18-21.

A small specimen of a shell which Mr. Schuchert identifies with this species was collected by him in 1895 at Bartlett's Mills (in the "Lower third of the section"). This specimen, which is No. 26,485 of the United States National Museum Catalogue of Invertebrate Fossils, is about fourteen lines in length, or height, and has most of the test preserved, although somewhat pyritized. Three specimens of essentially the same size and shape, but with little or no portion of the test preserved, had previously been found, one at Bartlett's Mills by the Rev. Hector Currie, and the others near Thedford by J. Townsend and G. Kernahan.

PLEUROTOMARIA ARKONENSIS. (N. Sp.)

Plate 48, figs. 12 and 12 *a*.

Shell depressed turbinate, nearly twice as broad as high and flattened below.

Volutions six, the first four forming a moderately elevated subconical spire, the last two almost step-shaped, and much more rapidly expanding laterally. Outer volution depressed, flattened next to the suture, then sloping obliquely downward, above, and truncated at the periphery: its surface marked by a spiral row of minute rounded tubercles, of uniform size and closely contiguous, above the slit-band, and by a similar row of tubercles below it; the upper row being placed about half way between the suture and the slit-band, and the lower one on the lower or anterior margin of the periphery. Slit-band placed on the outer edge of the apical side of this volution, and bounded by two minute and parallel spiral ridges, the outermost of which constitutes the upper or posterior margin of the periphery. Umbilicus apparently of moderate width in casts of the interior and rather narrow when the test is preserved, but all the specimens that the writer has seen have most of the umbilical surface covered by the matrix.

The foregoing description is based upon two specimens collected at Bartlett's Mills, by Mr. Kernahan, in 1895, both of which are now in the Museum of the Survey. One of these, which is figured, has the test preserved, and the other is a mere cast of the interior of the shell. The former, which is twenty millimetres in its maximum breadth, and about eleven mm. high, has most of the umbilical side covered with the matrix, and the flattening of the base is perhaps abnormal. A worn cast of the interior of a shell, which is probably referable to this species, in the Museum of the Survey, is labelled "Hamilton formation, Township of Plympton, A. Murray," and a similar but unworn cast was found at Thedford, a few years ago, by the Rev. Hector Currie. In each of these casts the outer portion of the last volution is obliquely flattened above and below, and the volution itself is encircled with four low, obtusely angular spiral ridges, one on each side of the periphery, one about half way between the suture and the upper or posterior margin of the periphery, and one which forms the umbilical margin.

EUOMPHALUS (PHANEROTINUS) LAXUS.

Euomphalus laxus, Hall. 1861. Descriptions of New Fossils, etc., p. 26.
" " " 1862. Fifteenth Rep. N.Y. St. Cab. Nat. Hist., p. 54, pl. 6, fig. 2.
Euomphalus (Ecculiomphalus?) laxus, Hall. 1876. Illustr. Devonian Fossils: Gasteropoda, pl. 16, figs. 16-18.
Ecculiomphalus comes, Hall. 1876. *Ibid.*, pl. 16, figs. 8 and 9.
Euomphalus (Phanerotinus) laxus, Hall. 1879. Pal. N. York, vol. V., pt. 2, p. 60, pl. 16, figs. 8, 9, and 16-18.

In the Museum of the Survey there are seven specimens, that are clearly referable to this species, which were collected in the Hamilton formation of the Township of Bosanquet, by Mr. Johnson Pettit, in 1868. Only one of these has any portion of the test preserved, the other six being mere decollated casts of the outer volution of the shell. A fine specimen, with two volutions and most of the test preserved, which is also referable to this species, was collected at Thedford, in 1897, by Mr. R. Mackintosh, who has kindly presented it to the Museum of the Survey.

The specimens from lakes Manitoba and Winnipegosis that are identified with the *Euomphalus annulatus* of Phillips, on page 325 of the fourth part of this volume, and figured on Plate 43, (figs. 1, 1*a*, & 2) seem to differ from this species only in being much more closely coiled.

LOXONEMA (Species undeterminable).

Two casts of the interior of the shell of a rather slender species of *Loxonema*, labelled simply "Widder," are among the old collections of the Survey, and were probably collected at least thirty years ago. Both of these casts are very imperfect posteriorly, but the more perfect of the two is two inches in length and has four volutions preserved, those of the spire being rather strongly convex, with an oblique suture. Scarcely any vestige of the test is preserved on either, but the cast of the last volution of each is marked by coarse, distant, flexuous, transverse plications. These specimens do not seem to agree very well with Hall's description and figures of any of the species of *Loxonema* from the Hamilton formation, in the second part of the fifth volume of the Palæontology of New York, but come rather close to the *L. pexata* of the Upper Helderberg limestone, and especially to the two specimens represented by figures 11 and 12 of Plate 13 of that volume.

PTEROPODA.

COLEOPRION (?) TENUIS, Hall.

Coleoprion (?) tenuis, Hall. 1879. Pal. N. York, vol. V., pt. 2, p. 184, pl. 32 A, figs. 1 and 2.

"In shales of the Hamilton group, associated with *Tentaculites bellulus* at Arkona, Ontario, C. W." Hall (*op. cit.*). For "Arkona," in this quotation, read Bartlett's Mills, near Arkona,—where the species is not very uncommon; and it is most likely that *Tentaculites bellulus* was written inadvertently for *T. attenuatus*.

HYOLITHES ACLIS, Hall.

Hyolithes aclis, Hall. 1876. Illustr. Devonian Fossils: Pteropoda, pl. 27, figs 5, 6, 7, 10 & 11.

" " " 1879. Pal. N. York, vol. V., pt. 2, p. 197, pl. 32, figs. 22-30; & pl. 32 A, figs. 23-25.

Bartlett's Mills, in the "Lower third of the section," C. Schuchert, 1895: a fragment, about six millimetres in length, of the pointed apical end of a specimen, which is identified with this species by Mr. Schuchert. The specimen, which the writer has examined, is No. 26,491 of the United States National Museum Catalogue of Invertebrate Fossils.

CEPHALOPODA.

ORTHOCERAS.

All the Orthocerata from the Hamilton formation of the province that the writer has seen are mere casts of the interior of the shell, with not a vestige of the test preserved, and the small species are represented by very fragmentary specimens. Under these circumstances the following provisional arrangement of the species is suggested.

A. Shell large.

A. 1. Chamber of habitation apparently much longer than the septate portion of the shell.

ORTHOCERAS ANAX, Billings.

Orthoceras Anax, Billings. 1875. Canad. Nat. and Geol., vol. VII, (N. S.), p. 238.

The original description of this species, which is the only one that has been published, is as follows. "Shell about two feet long and from three to three and a half inches in diameter at the aperture. Septa from six to eight in a length of two inches, where the diameter is eighteen lines.

Siphuncle nearly central, cylindrical or nearly so, two lines in thickness where the diameter of the shell is sixteen lines."

"The best specimens in the collection (those from one and a half to two feet in length) show none of the septa except in the five or six inches of the smaller extremity. One only, shows a single septum which is five and a half lines deep where the diameter is two inches and a quarter. In the same locality, and in the same state of preservation, were found a number of fragments in which there are eight or nine septa in a length of four inches, where the diameter is between two and three inches. I think these all belong to the same species."

Mr. Billings does not say whether his types of *O. Anax* are from the Hamilton formation or Corniferous limestone, but several specimens of a large *Orthoceras*, in the Museum of the Survey, which are labelled as having been collected in the Township of Bosanquet by Mr. J. Richardson, in 1855, and by Mr. Johnson Pettit, in 1858, are evidently the originals of the foregoing description. Six of these specimens, which are probably some of the "fragments" referred to, are much too imperfect for specific determination, but five are fine and apparently typical but very badly preserved examples of *O. Anax*. The approximate dimensions of three of these latter is as follows, commencing with the largest. No 1 (which is very slightly curved), total length twenty-one inches, of which between about four inches and three-quarters at the smaller end are distinctly septate; No. 2, total length sixteen inches and three-quarters, of which between three and four inches are septate; and No. 3, total length fourteen inches and a half, of which about two inches are septate. A fourth specimen, which is not more than five inches in length, is also probably the one upon which Mr. Billings based the statement that the siphuncle of *O. Anax* is "two lines in thickness where the diameter of the shell is sixteen lines."

Judging by these five specimens, and by Mr. Billings's description of the species, it would seem that the only distinctive character of *O. Anax* is the apparent length of its chamber of habitation, a character which is not exhibited in any of the Devonian species of *Orthoceras* described and figured by Hall in the second part of the fifth volume of the Palæontology of the State of New York, and one which is very possibly due to the imperfect preservation of the specimens.

A. 2. Chamber of habitation much shorter than the septate portion of the shell.

ORTHOCERAS LAMBTONENSE (Nom. prov.)

Plate 49, figs. 1 and 1 *a*

Shell longicone, increasing very slowly in thickness, and circular in transverse section: chamber of habitation nearly cylindrical, apparently unconstricted, much shorter than the septate portion; siphuncle almost central, small, and not encircled by an "elevated areola" at the septa (as in *O. Marcellense*, Hall), its elements between the septa unknown: surface markings unknown, though all the casts of the interior that the writer has seen are smooth and entirely devoid of a median central carina.

The most perfect specimen of this species that the writer has seen was collected near Thedford, in 1894, by Mr. Kernahan, who has kindly presented it to the Museum of the Survey. It is slightly imperfect at both ends, and its termination anteriorly is both irregular and indefinite, but its dimensions are approximately as follows: Total length, about seven inches; length of chamber of habitation, from two inches to two inches and a quarter; thickness, at the smaller end twenty-seven millimetres, at the larger forty-eight; number of septa preserved, seventeen; distance between two contiguous sutures, about six mm. and a half at the smaller end and eight mm. at the larger.

The only other specimens that the writer has seen which are clearly referable to this species, are three fairly good ones (two of which have part of the body chamber preserved), and three fragments, collected at Bartlett's Mills by G. Kernahan and C. Schuchert in 1895. All six are now in the United States National Museum, and are No. 26,442 of its Catalogue of Invertebrate Fossils. In one of these specimens the sutures of the septa are as much as nine and ten mm. apart.

The shortness of the chamber of habitation is practically the only character that is relied upon to distinguish this species from *O. Anax*. The former is very similar in shape to *O. Marcellense*, Hall, but that species is described as having an eccentric siphuncle encircled by an "elevated areola," and a median ventral carina on casts of the interior. The specific name for the fossil now under consideration is suggested by the fact that Thedford is in the county of Lambton.

B. Shell small.

B. 1. Siphuncle central, or nearly so.

ORTHOCERAS SUBULATUM (?) Hall.

Cfr. *Orthoceras subulatum*, Hall. 1843. Geol. Surv. N. York, Rep. Third Distr., p. 148.
" " " 1861. Descript. New Species of Fossils, etc., p. 49.
" " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 77.
" " " 1876. Illustr. Devonian Fossils: Cephalopoda, Expl. of pl. 38.
" " " 1879. Pal. N. York, vol. V., pt. 2, p. 283, pls. 38, fig. 3; 84, figs. 1, 2, 4, 6-10; and 86, figs. 1 and 2.

The name of *Orthoceras exile*, Hall, was included in a previous list of the fossils of this formation and province on the strength of a statement by Professor H. A. Nicholson, that "fragments of a slender *Orthoceras* which appear to belong to this species, are not rare in the Hamilton formation at Widder." The writer has not seen any of the specimens upon which this opinion was based, but most of the small Orthocerata from Thedford and Bartlett's Mills in the Museum of the Survey that have been loaned, for comparison, by local collectors, except those here referred to *Bactrites*, seem to agree better with Hall's latest description and figures of *O. subulatum* than with those of *O. exile*. In the remarks which follow the latest description of *O. exile* it is stated that it differs from *O. constrictum* and *O. subulatum* in its excentric siphuncle and more distant septa. The air chambers of *O. exile*, too, are described as "increasing in depth towards the outer chamber," and as "varying from two or three mm., to five mm., in the length of 100 mm., or about thirty chambers." With the exception of the *Bactrites* and of the two specimens here described as *O. Arkonense*, all the small Orthocerata from Thedford and Bartlett's Mills that the writer has seen, have a central or very nearly central siphuncle, about one millimetre in diameter. Some of them are crushed nearly flat, but others, which are undistorted, are circular in transverse section. The depth of the air chambers and consequent distance of the sutures apart, varies from as little as one millimetre throughout, to two or even three millimetres, in different specimens, though it is by no means certain that all these belong to the same species. However that may be, in this respect also they seem to agree better with the description of *O. subulatum* than with that of *O. exile*.

B. 2. Siphuncle eccentric.

ORTHOCERAS EXILE (Hall) Nicholson.

Orthoceras exile (Hall) Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 83.

Widder, Nicholson (*op. cit.*). See the remarks on the preceding species.

ORTHOCERAS ARKONENSE. (N. Sp.)

Plate 48, figs. 13, 14 and 14 *a*.

Shell slender, longicone, almost cylindrical, but slightly compressed, so that the outline of a transverse section is broadly elliptical: air chambers, except the three or four next to the chamber of habitation, so deep that the distance between the sutures is greater than the maximum diameter of the tube; siphuncle eccentric, only observed at the septa. Surface markings unknown.

Bartlett's Mills, G. Kernahan, 1894 : the two specimens figured, which he has kindly presented to the Museum of the Survey. The smaller of these (figs. 14 and 14 *a*) is an undistorted fragment fifteen millimetres in length, and five mm. and a half in its greatest diameter, consisting of two whole air chambers and part of a third. The distance between the posterior septum and the one next to it, in this fragment is nearly seven mm. The larger one, the original of figure 13 on the same Plate, is about forty mm. in length. It is slightly but abnormally compressed, and consists of eight air chambers, the four posterior ones being deep with the septa widely distant, and the four anterior ones shallow with the septa comparatively near together.

The salient features of this species would seem to be the great distance of the septa apart, at a short distance from the body chamber, coupled with the very slender contour of the shell, and its eccentric siphuncle.

BACTRITES (OBLIQUESEPTATUS ? var.) ARKONENSIS.

Plate 48, figs. 15, 16 and 16 *a*.

Cfr. *Orthoceras obliqueseptatum*, G. and F. Sandberger. 1853. Verstein. Rheinisch. Schichten-syst. Nassau, p. 160, pl. 18, figs. 2, 2 *a-e*.

" *Bactrites obliqueseptatus*, Hyatt. 1883. Genera of Fossil Cephalopoda (in Proc. Boston Soc. Nat. Hist., vol. XXII.) p. 304.

Shell resembling that of *B. obliqueseptatus* in (1) its small size ; (2) its slightly compressed sides and consequently broadly elliptical outline in transverse section ; (3) its oblique septa, as viewed laterally ; and (4) in its marginal and presumably ventral siphuncle ;—and differing therefrom only in the circumstance that the minute sinus of each suture at the siphuncle, which Hyatt calls the ventral sinus, is not developed in the majority of specimens.

Thus, out of about fifty specimens from the Hamilton formation of Ontario that the writer has recently examined with a lens, only some five or six have the ventral sinus distinctly developed. In all the others the sutures are straight and continuous where they pass over the siphuncle. Yet, in the specimen represented, enlarged four times, on Plate 48, figs. 16 and 16*a*, which consists of ten air chambers, the ventral sinus is distinctly visible on each of the septa. Moreover, the Sandbergers, in their original description of *Bactrites*, say that this sinus, which they call the "dorsal lobe," and regard it, as Hyatt says, as "due to the approximation of the funnels to the side," is sometimes entirely wanting ("*interdum omnino nullus*"). In their representation too (*op. cit.*, pl. 18, fig. 2 *e*) of the siphonal or ventral side of two of the air chambers of *Orthoceras obliqueseptatum*, magnified, the exposures of the siphuncle at each of the sutures is so irregular in outline as to be evidently due to minute imperfections or breaks in the casts of the interior, or of the shell wall of these chambers.

This little pyritized *Bactrites* is abundant at Bartlett's Mills, but not quite so common at Thedford. At both of these localities specimens were collected by the Rev. Hector Currie in 1882, and more recently by Messrs. Kernahan, Schuchert, Walker and others. Altogether the writer has seen nearly a hundred of these specimens, the largest of which are not quite an inch long. Some of them are casts of the interior of the body chamber, either alone, or with one, two or more of the air chambers attached. In such specimens the body chamber is from nineteen to twenty-three millimetres long, and its dorso-ventral diameter anteriorly averages five mm. Others are casts of considerable portions of the septate end of the shell, sometimes with a small piece of that of the body chamber, and in one of the former fourteen septa can be counted in a fragment that is a little over fifteen mm. in length. Figure 15 on Plate 48 is a composite drawing, the body chamber being drawn from one specimen and the septate portion from another.

NEPHRITICERAS LIRATUS, Hall. (Sp.)

Gyroceras liratum, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 104.
" " " 1876. Illustr. Devonian Fossils: Cephalopoda, pl. 57, figs. 5, 6; pl. 58, figs. 1, 2; and pl. 60, figs. 8, 9.
Nautilus liratus, Hall. 1879. Pal. N. York, Vol. V., pt. 2, p. 407, pl. 57, figs. 3; and pl. 60, figs. 8 and 9.

Two imperfect and badly preserved nautiloid shells in the Museum of the Survey, collected in the Township of Bosanquet, by Mr. Pettit, in 1868, seem to represent a form of this species in which the spiral ribs are rather more numerous than usual. One of these, a cast of the interior of the five last air chambers and of a considerable portion of the chamber of habitation, about 100 millimetres in length and about sixty-three in breadth at the aperture, has from thirty-five to forty spiral ribs. The other, which is a distorted cast of the chamber of habitation of a much larger specimen, about 141 milimetres in length and 103 mm. in breadth at the aperture, shows no indication of any ribs.

In his latest description of *N. liratus*, Hall says that in the typical specimen there are "fourteen revolving ridges over the chambered portion of the shell," and that in another specimen there are "nine strong plications seen on the lateral face of a partially compressed grand chamber." But, in the specimen of *N. liratus* represented by fig. 9 of Plate 60 of the second part of the fifth volume of the Palæontology of the State of New York, as many as fifteen ribs can be counted in one half of the circumference.

CRUSTACEA.

OSTRACODA.

PRIMITIOPSIS PUNCTULIFERA, Hall. (Sp.)

Leperditia punctulifera, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 92.
Cythere? punctulifera, Nicholson. 1873. Rep. Pal. Prov. Ont., p. 124.
Primitiopsis punctulifera, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI., pp. 3 and 9, pl. 2, figs. 7, *a-b*; 12, *a-b*; and 13, *a-b*.
" " Jones. 1891. Contr. to Canad. Micro-Palæont., p. 95, pl. 11, figs. 10 and 11, *a-b*.

This little species, which is common at Thedford and its vicinity, where it was first recognized by Prof. H. A. Nicholson, is now referred by Professor T. Rupert Jones to his genus *Primitiopsis*.

ULRICHIA CONRADI, Jones.

Ulrichia Conradi, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI., p. 544, fig. 2.
" " Jones. 1891. Contr. to Canad. Micro-Palæont., p. 95, pl. 11, fig. 13.

The type of this species is a "small left valve" collected at Thedford, by Dr. G. J. Hinde.

BARYCHILINA WALCOTTI, Jones.

Primitia (?) Walcotti, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI., p. 543, fig. 1.
Kirkbya (?) Walcotti, Jones. 1891. Contr. to Canad. Micro-Palæont., p. 96, pl. 11, figs. 12, *a-b*.

In a letter to the writer, dated June 2nd, 1896, Professor Jones states that the proper name for this species, which was based upon a single imperfect valve from Thedford collected by Dr. G. J. Hinde, is *Barychilina Walcotti*.

PHYLLOPODA.

ELYMOCARIS HINDEI, Jones and Woodward.

Elymocaris Hindei, Jones and Woodward. 1894. Geol. Mag., N. S., Dec. IV., vol. I., p. 293, pl. 9, fig. 7.

Arkona, Dr. G. J. Hinde: "two valves of a carapace. The right valve is nearly perfect, but has lost a piece off the hinder end, and is somewhat cracked by pressure. The other valve lies obliquely and partly embedded."

TRILOBITA.

PROETUS ROWI, Green.

Calymene Rowii, Green. 1838. Amer. Journ. Sc. and Arts, vol. XXXIII., p. 406.
Proetus Rowii, Hall. 1861. Descript. New Species of Fossils, etc., p. 75.
" " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 103.
" " " 1876. Illustr. Devonian Fossils, pl. 21, figs. 2-6.
" " Hall and Clarke. 1888. Pal. N. York, vol. VII., p. 119, pl. 21, figs. 2-6, 24-26; and pl. 23, figs. 20-29.

A few nearly perfect but doubled up specimens of this species have been collected near Thedford, within the last four or five years, by Messrs. Kernahan, Kearney, Schuchert and Walker. One of these has been kindly presented to the Museum of the Survey by Mr. Kernahan.

PROETUS CRASSIMARGINATUS, Hall.

Calymene crassimarginatus, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 172, fig. 5.
Proetus crassimarginata, Hall. 1859. Twelfth Rep. N. Y. St. Cab. Nat. Hist., p. 88.
Phillipsia (?) *crassimarginata*, Billings. 1861. Canad. Journ., vol. VI., p. 362.
Proetus crassimarginatus, Hall. 1861. Descript. New Species of Fossils, etc., p. 72.
" " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 100.
" " " 1876. Illustr. Devonian Fossils, pl. 20, figs. 20-31.
Proetus Conradi, Hall. 1876. *Ibid.*, pl. 20, figs. 5, 8 and 9.
Proetus crassimarginatus, Hall. 1888. Pal. N. York, vol. VII., p. 99, pl. 20, figs. 6-8, 20-31; pl. 22, figs. 20-26; and pl. 25, fig. 8.

The writer is informed by Mr. Schuchert that he has obtained a perfect specimen of this species from the "Lower third of the section" at Bartlett's Mills.

FISHES.

PTYCTODUS CALCEOLUS, Newberry & Worthen. (Sp.)

Rinodus calceolus, Newberry & Worthen. 1866. Palæont. Ill., vol. II., p. 106, pl. 10, fig. 10.
Ptyctodus calceolus, Newberry. 1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2; p. 59, pl. 59, figs. 13 and 13 *a*.

An upper tooth, or rather the tritoral area of an upper tooth, which has been identified with this species by Mr. A. Smith Woodward, was collected at Thedford by the Rev. J. B. Goodwillie, in 1882, and presented by him to the Museum of the Survey. Its maximum length is about thirty-four millimetres. A much smaller but otherwise essentially similar specimen was collected on the Rivière aux Sables, at Hill No. 4, near Thedford, by the writer in 1891.

ASPIDICHTHYS NOTABILIS (?) Whiteaves.

Plate 50, figs. 1 and 2

Cfr. *Aspidichthys notabilis*, Whiteaves. 1892. This volume, pt. 4, p. 354, pl. 47, figs. 1 and 1 *a*.

Numerous small fragments of the dermal armature of fishes, from Thedford and Bartlett's Mills, with a surface ornamentation very similar to that of the cranial plates of *Macropetalichthys Sullivanti* were identified with that species on page 119 of the second part of this volume. Quite recently, however, the discovery, at Bartlett's Mills, of the two much larger fragments represented on Plate 50, has convinced the writer that the identification of the smaller ones with *M. Sullivanti* is no longer tenable. Both of the specimens figured are quite flat externally and hence clearly are part of the ventral region of the fish, and not of the dorsal or cranial. In both, also, there is a large, longitudinally median, tuberculated area, and, when perfect, both evidently had a broad, smooth, bevelled outer margin on both sides, for the overlap of lateral plates, and hence must have formed part of the median element. The original of fig. 1 on Plate 50 was collected in 1897 by Mr. Kernahan, who has kindly presented it to the Museum of the Survey. In it a portion of the smooth, bevelled surface, on each side of the tuberculated area, is preserved. The specimen represented by figure 2, on the same Plate, was collected by Mr. Kearney, in 1875, and is also in the Museum of the Survey. It is only a large portion of the right side of the plate (as viewed with the ventral surface uppermost) not far from its midlength, with the margin bevelled on the right of the tuberculated area, but in two directions, as if for the overlap of two lateral plates. Both of these specimens are evidently referable to *Aspidichthys* rather than to *Macropetalichthys*, and would seem to have formed portions of the ventromedian plate of a fish which at present can scarcely be satisfactorily distinguished from *A. notabilis*. The specimen collected by Mr. Kernahan (fig. 1) probably represents part of the anterior end of such a plate, though it shows no indication of the transverse, terminal, crescentic bevelled area preserved in the type of *A. notabilis*, and that collected by Mr. Kearney, (fig. 2) seems to be a portion of the right side of a similar plate.

PLATE (OR SCALE), GENUS AND SPECIES INDETERMINABLE.

Plate 50, fig. 3.

The singular plate or scale represented on Plate 50, is labelled "Bosanquet, Range 3, Lot 24," and was evidently collected before the "Geology of Canada" was published (in 1863), as this particular locality is referred to on page 382 of that volume. The organic part of the specimen is thin, nearly flat, somewhat diamond shaped, but unsymmetrical and unequal sided, with one of the sides deeply and almost angularly concave. Its maximum diameter is twenty-six millimetres, and its surface ornamentation consists of numerous, fine and closely disposed radiating raised lines or minute ridges, which are crossed by equally fine concentric striæ or lines of growth.

REVISED LIST OF THE FOSSILS OF THE HAMILTON FORMATION OF ONTARIO.

The arrangement of the species of this list, as in a previous one, is generally in accordance with the classification adopted by Zittel in his Handbuch der Palæontologie, but with some exceptions. The crinoids are arranged as in Wachsmuth and Springer's monograph on the Crinoidea Camerata, the polyzoa or bryozoa as in Ulrich's latest "Systematic classification of the Palæozoic Bryozoa,"* the brachiopoda as in Mr. Schuchert's "Synopsis of American Fossil Brachiopoda," and the pelecypoda as in Hall's monograph of the Devonian Lamellibranchiata.†

The authority for the identification is given in the case of a few species that the writer has seen no specimens of, and that have not been previously referred to in this paper.

CŒLENTERATA.

SPONGIÆ.

Receptaculites Neptuni, Defrance. "Near Widder, Ontario," Dr. G. J. Hinde.
Astræospongia Hamiltonensis, Meek and Worthen.
Supposed bundles of spicules.
Supposed Cliona borings.

ANTHOZOA.

ALCYONARIA.

Aulopora serpens (Goldfuss ?) Rominger.
Monilopora antiqua, Whiteaves.

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* In volume three, part one, of the Final Report of the Geological Survey of Minnesota.
† In volume five of the Palæontology of the State of New York.

ZOANTHARIA.

(A. *Tetracoralla*, Hæckel := *Rugosa*, Edwards and Haime.)

Microcyclus discus, Meek and Worthen.
Zaphrentis cornicula, Lesueur.
Heterophrentis prolifica, Billings.
Cyathophyllum Zenkeri, Billings.
Heliophyllum exiguum, Billings.
" Halli, Edwards and Haime.
" juvene (Rominger).
" tenuiseptatum, Billings.
Blothrophyllum conatum (Hall).
Crepidophyllum Archiaci (Billings).
" subcæspitosum (Nicholson).
Diphyphyllum strictum (Edwards and Haime).
Acervularia profunda, Hall.
Phillipsastræa Vernueili, Edwards and Haime.
Cystiphyllum Americanum, Edwards and Haime.
" conifolle, Hall.
" superbum, Nicholson.
" vesiculosum, Goldfuss.

(B. *Hexacoralla*, Hæckel := *Tabulata*, Edwards and Haime.)

Favosites Alpenensis, Winchell.
" arbuscula, Hall.
" Billingsi, Rominger.
" clausa, Rominger.
" placenta, Rominger.
" turbinata, Billings.
Ræmeria ramosa, Whiteaves
Alveolites Goldfussi, Billings.
Striatopora Linnæana, Billings.
Cladopora Fischeri (Billings).
" frondosa (Billings).
" Ræmeri (Billings).
Trachypora elegantula, Billings.
" ornata (=Dendropora ornata, Rominger, teste Nicholson).
Syringopora intermedia, Nicholson.
" nobilis, Billings.

HYDROMEDUSÆ.

HYDROIDA.

Clathrodictyon retiforme (Nicholson and Murie).
Stromatopora mamillata, Nicholson.
Stromatoporella granulata, Nicholson.
" incrustans, Hall and Whitfield, sp. (=Stromatopora nulliporoides, Nicholson.)

ECHINODERMATA.

CRINOIDEA.

Gilbertsocrinus spinigerus (Hall).
Dolatocrinus Canadensis, Whiteaves.
" subaculeatus, Whiteaves.

Dolatocrinus. (N. Sp.)
" (Species uncertain.)
Megistocrinus rugosus, Lyon and Casseday.
Gennæocrinus Arkonensis, Whiteaves.
Arthoacantha punctobrachiata, Williams.
Taxocrinus lobatus (Hall).
Botryocrinus crassus (Whiteaves).
Ancyrocrinus bulbosus, Hall.

BLASTOIDEA.

Pentremites Lycorias, Hall.
Pentremitidea filosa, Whiteaves.
Nucleocrinus elegans, Conrad.
Granatocrinus leda (Hall).
Codaster Canadensis, Billings.
Eleutherocrinus Cassedayi, Shumard and Yandell.

ASTEROIDEA.

Palæaster eucharis, Hall.

VERMES

Spirorbis angulatus, Hall.
" Arkonensis, Nicholson.
" omphalodes (Goldfuss) Nicholson.
" spinuliferus, Nicholson.
Autodetus Lindstroemi, Clarke.
Ortonia intermedia, Nicholson.
Eunicites alveolatus, Hinde.
" nanus, Hinde.
" palmatus Hinde.
tumidus, Hinde.
Ænonites compactus, Hinde.
Arabellites politus, Hinde.
" similis, var. arcuatus, Hinde.
Nereidavus solitarius, Hinde.

Rivière aux Sables," Dr. G. J. Hinde.

MOLLUSCOIDEA.

POLYZOA.

Intrapora cosciniformis (Nicholson).
" elegantula (Hall).
Coscinium striatum Hall.
Cystodictya incisurata (Hall).
" incrassata (Hall).
" Meeki (Nicholson).
" rectilinea (Hall).
Semiopora bistigmata, Hall.
Tæniopora exigua, Nicholson.
" penniformis, Nicholson.
Scalaripora Canadensis, Whiteaves.

Streblotrypa Hamiltonensis (Nicholson).
Fenestella Arkonensis, Whiteaves.
" Davidsoni, Nicholson.
" filiformis, Nicholson.
" Nicholsoni, Whiteaves.
Retepora prisca, Nicholson.
Polypora Arkonensis, S. A. Miller.
Ptilopora striata, Hall.
Trematopora carinata, Hall.
Leioclema minutissimum (Nicholson).
Amplexopora Barrandi (Nicholson).
" moniliformis (Nicholson).
Leptotrypa quadrangularis (Nicholson).
Ceramopora Huronensis, Nicholson.
Fistulipora Romingeri, Nicholson & Foord.
" subtilis, Hall.
" utriculus, Rominger.
" variopora (Hall).
Lichenalia ramosa, Hall.
" stellata, Hall.
" subtrigona, Hall.
Pinacotrypa elegans (Rominger).
Botryllopora socialis, Nicholson.
Hederella Canadensis (Nicholson).
" cirrhosa, Hall.
" filiformis (Nicholson).
" magna, Hall.
Ascodictyon fusiforme, Nicholson.
" stellatum, Nicholson.

BRACHIOPODA.

Lingula ligea, Hall.
" Thedfordensis, Whiteaves.
Orbiculoidea Doria (Hall).
Crania crenistriata, Hall.
Craniella Hamiltoniæ (Hall).
Stropheodonta concava, Hall.
" demissa (Conrad).
" inæquistriata (Conrad).
" plicata, Hall.
Leptostrophia perplana (Conrad).
Pholidostrophia Iowensis (Owen).
Leptæna rhomboidalis (Wilckens).
Orthothetes anomalus (A. Winchell).
" Chemungensis, var. arctostriatus, Hall.
" " var. perversus, Hall.
Chonetes carinata (or coronata) Conrad.
" lepida, Hall.
" lineata, Conrad.
" scitula, Hall.
" vicina (Castelneau).
Strophalosia radicans (A. Winchell).
" truncata? (Hall).

Productella productoides? (Murchison).
Orthis (Rhipidomella) Penelope, Hall.
" " Vanuxemi, Hall.
Pentamerella Pavilionensis? Hall.
Gypidula læviuscula, Hall.
Camarotoechia Sappho (Hall).
" Thedfordensis, Whiteaves.
Leiorhynchus Laura. (=Rhynchonella Laura, Billings; and Leiorhynchus Huronensis, Nicholson.)
" iris, Hall.
Pugnax Kernahani, Whiteaves.
Cyclorhina nobilis, Hall.
Eunella attenuata, Whiteaves.
" harmonia, Hall.
" simulator, Hall.
Cranæna Romingeri, Hall.
Tropidoleptus carinatus, Hall.
Atrypa reticularis, L.
" spinosa, Hall.
Spirifera audacula (Conrad).
" divaricata, Hall.
" euryteines, Owen.
" granulosa (Conrad).
" pennata (Atwater).
" subdecussata, Whiteaves.
Delthyris consobrina (d'Orbigny).
" sculptilis, Hall.
Reticularia fimbriata (Conrad).
Martinia Maia (Billings).
Cyrtina Hamiltonensis, Hall.
Ambocœlia umbonata (Conrad).
Rhynchospira? Eugenia (Billings).
Parazyga hirsuta, Hall. (=Athyris Chloe, Billings.)
Athyris Fultonensis (Swallow). Teste C. Schuchert.
" spiriferoides (Eaton).
Meristella Barrisi, Hall.
" Haskinsi, Hall.
" rostrata, Hall.
Charionella scitula, Hall.
Pentagonia unisulcata, Conrad.

MOLLUSCA.

PELECYPODA.

Pterinea flabellum (Conrad).
Actinopteria Boydii (Conrad).
Leiopteria Rafinesquii, Hall.
Limoptera macroptera (Conrad).
Microdon (Cypricardella) bellistriatus? Conrad.
Nucula lirata, Conrad.
Nuculites triqueter, Conrad.
Leda rostellata (Conrad).

Palæoneilo plana, Hall.
Nyassa arguta, Hall.
Grammysia arcuata? Conrad. Var.
Paracyclas lirata (Conrad).
Orthonota parvula, Hall.

GASTEROPODA.

Platyceras carinatum, Hall.
" dumosum, var. rarispinum.
" erectum, Hall.
" quinquesinuatum, Ulrich.
Platyceras (Orthonychia) conicum, Hall.
Platyostoma lineatum, Conrad.
" plicatum, Whiteaves.
" Shumardi. (= Turbo Shumardi, de Verneuil.)
" turbinatum? Conrad.
Pleurotomaria Arkonensis, Whiteaves.
" capillaria, Hall.
Euomphalus (Phanerotinus) laxus, Hall.
Loxonema. (Species undeterminable.)

PTEROPODA.

Tentaculites attenuatus, Hall.
Coleoprion (?) tenuis, Hall.
Hyolithes aclis, Hall.

CEPHALOPODA.

Orthoceras Anax, Billings.
" Lambtonense, Whiteaves.
" subulatum? Hall.
" exile? Hall.
" Arkonense, Whiteaves.
Bactrites (obliqueseptatus? var.) Arkonense, Whiteaves.
Goniatites uniangularis, Conrad.
Nephriticeras liratus, Hall.

CRUSTACEA.

OSTRACODA.

Primitiopsis punctulifera (Hall).
Ulrichia Conradi, Jones.
Barychilina Walcotti, Jones.

PHYLLOPODA.

Elymocaris Hindei, Jones and Woodward.

TRILOBITA.

Phacops rana, Green.
Dalmanites (Cryphæus) Boothii, Green.
Proetus crassimarginatus, Hall.
" Rowi (Green).

FISHES.

Ptyctodus calceolus, Newberry and Worthen.
Aspidichthys notabilis ? Whiteaves.
Plate, or scale, genus and species uncertain.

GEOLOGICAL SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY

VOLUME I.

BY J. F. WHITEAVES.

APPENDIX

8. *Revision of the nomenclature of some of the species described or enumerated in previous parts of this volume, and additional notes on others, necessitated by the progress of palæontological research.*

PART 1.

Page 87.

For "HOPLOPARIA ? CANADENSIS, Whiteaves"—and the single reference which follows, read :

LINUPARUS CANADENSIS, Whiteaves.

Hoploparia ? Canadensis, Whiteaves. 1884. Trans. Royal Soc. Canada, vol. II., sect. 4, p. 238.

" " Whiteaves. 1885. This volume, pt. 1, p. 87, pl. 11.

Podocrates Canadensis, Whiteaves. 1896. Trans. Royal Soc. Canada, N. S., vol. I., sect. 4, p. 133.

Linuparus atavus, Ortmann. 1897. Amer. Journ. Sc. and Arts, 4th Series, vol. IV., p. 290, and figs. 1, 2 and 3, facing p. 296.

In 1890, Dr. Clemens Schluter, of Bonn, suggested to the writer that the specimen figured on Plate 11 of this volume is clearly a species of *Podocrates*, closely allied to if not identical with *P. Dulmenensis*, as stated in the Transactions of the Royal Society of Canada for 1895.

Still more recently, on receipt of the American Journal of Science for October, 1897, containing a description, with illustrations, of *Linuparus atavus*, the writer was struck with the resemblance of the specimens figured under that name to *Podocrates Canadensis.* In a correspondence which ensued, Dr. Ortmann says that he is now fully convinced of the identity of *Linuparus atavus* with *Podocrates Canadensis*, and that the species should be referred to the genus *Linuparus*, which was proposed by Gray, in 1847,* and based upon the recent *Palinurus trigonus* of De Haan. He also says that the genus *Podocrates* was first published by Geinitz in 1850, and that it is founded on a *good* figure.

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*List of the specimens of Crustacea in the British Museum, p. 70.

PART 2.

Page 151.

For "AUCELLA MOSQUENSIS, var. CONCENTRICA," and the list of its synonyms, substitute the following.

AUCELLA CRASSICOLLIS, Keyserling.

Aucella crassicollis, Keyserling. 1846. Reise in das Petschora-Land, p. 300, pl. 16, figs. 9-12.

Aucella Piochii, Gabb. 1869 (In part.) Palæont. California, vol. II., p. 194, pl. 32, figs. 92, *a-c*.

Aucella Piochii, (Gabb) Whiteaves. 1882 (In part.) Trans. Royal Soc. Canada, vol. I., sect. 4, p. 84.

" " Whiteaves. 1884. Geol. Surv. Canada, Mesoz. Fossils, vol. I., pt. 3, p. 239.

Aucella concentrica, (Fischer) White. 1884. Bull. U. S. Geol. Surv., No. 4, p. 13, pl. 6, figs. 2-12: and (1885) *Ibid.*, No. 15, p. 23.

Aucella Piochii, (Gabb) Whiteaves. 1887 (In part.) Geol. and Nat. Surv. Canada, Ann. Rep. N. S., vol. II., p. 111 A.

Aucella concentrica, (Fischer) White. 1889 (In part.) Mon. U. S. Geol. Surv., No. 13, p. 231, pl. 4, figs. 3-5, 11-17 and 21.

Aucella crassicollis and var *gracilis*, Lahusen. 1888. Ueber Russischen Aucellen, pp. 24 & 42, pl. 5, figs. 8-16.

Aucella piriformis, Lahusen. 1888. *Ibid.*, pp. 24 & 42, pl. 5, figs. 1-7.

Aucella crassicollis, (Keyserling) Stanton. 1895. Bull. U.S. Geol. Surv., No. 133, p. 45, pl. 5, figs. 1-13; and pl. 6, figs. 1-5.

Since the publication of Lahusen's monograph on the Russian Aucellæ, it has become obvious that the specimens which are so abundant at many localities in British Columbia, can no longer be regarded as varieties of *A. concentrica*.

Mr. Stanton, who has examined a series of specimens from that province, expresses the opinion that the Aucellæ from the Skagit River, collected by Dr. G. M. Dawson, in 1877, are *A. Piochii*, var *ovata*, but that those from all the other localities mentioned on pages 151 and 152 of this volume, should be referred to *A. crassicollis*, Keyserling. All the Aucellæ that the writer has yet seen from Canadian localities are from a well-defined horizon in the Earlier North American Cretaceous.

Page 156.

For "PLACENTICERAS PEREZIANUM"—read :

DESMOCERAS PEREZIANUM.

And, add to the list of references :

Desmoceras Perezianum, Whiteaves. 1892. Trans. Royal Soc. Canada, vol. X., sect. 4, p. 114.

Page 158.

For "PLACENTICERAS (PEREZIANUM? var.) LIARDENSE"—read:

DESMOCERAS (PEREZIANUM? var.) LIARDENSE.

The systematic position of the four specimens upon which this species was based is still doubtful, and they are now only provisionally referred to *Desmoceras*. Their previous reference to *Placenticeras* was based upon Zittel's extension of the characters of that genus so as to include the Clypeiformes, and has not proved satisfactory.

Page 159.

For "DISCINA PILEOLUS. (N. Sp.)"—read:

ORBICULOIDEA DAWSONI. (Nom. nov.)

Discina pileolus, Whiteaves, 1889. This volume, p. 159, pl, 21, figs. 3 and 3 *a*, but not *D. pileolus*, Hicks, 1866, which is probably also an *Orbiculoidea*.
Discina Dawsoni, Whiteaves. 1893. Trans. Royal. Soc. Canada, vol. XI., sect. 4, p. 17.

Page 172.

For "PLACENTICERAS GLABRUM. (N. Sp.)"—read:

DESMOCERAS AFFINE, var. GLABRUM.

Placenticeras glabrum, Whiteaves. 1889. This volume, p. 172, pl. 24, figs. 1 and 1 *a-b*.
Desmoceras affine, var. *glabrum*, Whiteaves. 1892. Trans. Royal Soc. Canada, vol. X., sect. 4, p. 115, pl. 9.

The type of *Placenticeras glabrum* is a small and perfectly smooth cast of the interior of the shell, collected by Mr. W. Ogilvie, in 1885, from the Cretaceous rocks of the Peace River, a few miles below Fort Vermilion. Numerous other specimens, from rocks of similar age on the Peace River and its tributaries, collected by Mr. McConnell in 1889, were described and figured in the Transactions of the Royal Society of Canada for 1892. As the surface of none of these specimens can be called smooth, or even very nearly smooth, the species was redefined under the name *Desmoceras affine*, on account of its close resemblance to *D. Beudanti*, and the name *glabrum* retained in a varietal sense and restricted to those specimens in which the distant periodic arrests of growth are not developed.

PART 3.

Page 202.

For "CAMPOPHYLLUM ELLIPTICUM"——read:

CYATHOPHYLLUM MCCONNELLI. (N. Sp.)

The reference of the three corals from the Hay River, mentioned on p. 202, to the *Chonophyllum (Ptychophyllum) ellipticum* of Hall and Whitfield, under the name *Campophyllum ellipticum*, has not proved satisfactory. Professor Calvin, who has recently compared the best of them, the original of Plate 27, fig. 5, of this volume, with Iowa specimens, thinks that it is generically but not specifically identical with Hall and Whitfield's species. Rominger, also, in his Fossil Corals of Michigan, page 104, says that *C. ellipticum* is not a *Chonophyllum* but a *Cyathophyllum* allied to *C. Houghtoni.* Under these circumstances it seems most prudent to distinguish the three Hay River specimens formerly designated as *Campophyllum ellipticum* by the foregoing new specific name, in honour of their discoverer, and to refer them provisionally to the genus *Cyathophyllum.*

Page 204.

"PHILLIPSASTRÆA HENNAHI, Lonsdale."

The corals from the Peace and Hay rivers which were referred to this species, were so identified solely by their external characters. Sections since made shew that they and the specimens from the Hay River referred to *Phillipsastræa Verrillii*, have more the structure of *Pachyphyllum* than of *Phillipsastræa* proper, though Rominger maintains (Fossil Corals of Michigan, page 127) that the separation of these two genera is both "artificial and inappropriate." It is quite likely that all those which have been identified with *Phillipsastræa Hennahi* are mere varieties of *Pachyphyllum Woodmani*, although the specimens from the Hay River have rather smaller and less prominently exserted calyces, with a somewhat smaller number of septa.

Page 205.

"PHILLIPSASTRÆA VERRILLII, Meek. (Sp.)"

See the remarks on the preceding species.

Page 206.

For "PACHYPORA CERVICORNIS, DeBlainville. (Sp.)"—read:

CLADOPORA CERVICORNIS, De Blainville. (Sp.)

Mr. L. M. Lambe, who is making a special study of Canadian Palæozoic corals, thinks that *Pachypora*, Lindstrom, is synonymous with *Cladopora*, Hall.

Page 207.

For "ALVEOLITES RÆMERI, Billings"—read:

CLADOPORA RÆMERI, Billings. (Sp.)

And, after the paragraph referring to that species, insert the following.

CLADOPORA TURGIDA, Rominger.

Cladopora turgida, Rominger. 1876. Geol. Surv. Michigan, Fossil Corals, p. 48, pl. 19, fig. 2.

A fragment of a specimen from the Ramparts, Mackenzie River, collected by Robert Kennicott, loaned by the U. S. National Museum and labelled No 14,554, has been identified with this species by Mr. Lambe.

Page 216.

For "STROPHALOSIA PRODUCTOIDES, Murchison"—read:

PRODUCTELLA PRODUCTOIDES, Murchison. (Sp.)

And, add to the list of references:

Productella productoides, Hall & Clarke, 1892. Pal. N. York, vol. VIII., pt. 1, p. 317.

Page 217 (and pt. 4, page 283).

PRODUCTELLA SUBACULEATA and its var. CATARACTA.

On page 318 of his recently published Synopsis of American Fossil Brachiopoda, Mr. Schuchert expresses the opinion that "for the present it is preferable to retain the name *P. spinulicosta*" for the American Devonian forms which have been identified with *P. subaculeata*, and its var *cataracta*. In that publication he includes the specimens referred to under the name *P. subaculeata*, var *cataracta* on page 217, and those identified with the typical form of *P. subaculeata* on page 283, of this volume, in the synonymy of *P. spinulicosta*. On the other hand, it is to be noted that the Rev. G. F. Whidborne, in his Devonian Fauna of the South of England, vol. II., pt. 3 (1893), p. 155, says that *P. spinulicosta* and *P. subaculeata* var *cataracta*, are both varieties of *P. subaculeata*.

Page 222.

For "SPIRIFERA CYRTINÆFORMIS, Hall and Whitfield"—read:

CYRTIA CYRTINÆFORMIS, Hall and Whitfield. (Sp.)

And, add to the list of references:

Cyrtia cyrtinæformis, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 42, pl. 25, figs. 26-32.

Page 230.

For "RHYNCHONELLA PUGNUS, Martin"—read:

PUGNAX PUGNUS, Martin (Sp.)

And, add to the list of references:

Pugnax pugnus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 203, pl. 60 figs. 6-10.

Page 231.

For "RHYNCHONELLA CUBOIDES, Sowerby".—read:

HYPOTHYRIS CUBOIDES, Sowerby. (Sp.)

And, add to the list of references:

Hypothyris cuboides, Hall & Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 200, pl. 60, figs. 49-55.

Professors Hall and Clarke claim that the *Atrypa cuboides* of Sowerby, the *Rhynchonella cuboides* of Davidson and other palæontologists, is the type of McCoy's genus *Hypothyris* as defined by King, and hence that it must be called *Hypothyris cuboides* (Sowerby). Mr. Schuchert, however, who regards *Rhynchonella Emmonsi* as distinct from *R. cuboides*, thinks that the specimens collected by Mr. McConnell on the Hay and Peace rivers are referable to the former rather than to the latter species, and that they should be called *Hypothyris Emmonsi* (Hall and Whitfield).*

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* See his "Synopsis of American Fossil Brachiopoda" (1897) p. 233.

Page 232.

For "RHYNCHONELLA CASTANEA, Meek"—read :

HYPOTHYRIS CASTANEA, Meek. (Sp.)

And, add to the list of references :

Liorhynchus castaneus, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 59, figs. 28 and 29.
Hypothyris castanea, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 233.

Page 234.

For "PENTAMERUS GALEATUS, Dalman. Var."—read :

GYPIDULA GALEATA (Dalman). Var.

And, add to the list of references :

Sieberella galeata, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 246, fig. 175, pl. 72, figs. 7-13.
Gypidula galeata, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 226.

Page 235.

For "CRYPTONELLA CALVINI ? Hall and Whitfield"—read:

DIELASMA CALVINI ? Hall and Whitfield.

And, add to the synonymy and references:

Dielasma Calvini, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 296, pl. 80, figs. 20-22.

In their remarks upon the genus *Dielasma*, King (op. cit.) Professors Hall and Clarke say: "the *Cryptonella Calvini* of Hall and Whitfield, of the middle Devonian of Iowa, is an excellent representative of the early forms of this genus."

PART 4.

Page 270.

Line 13, from the bottom, for "*length*" read "*breadth*."

Page 273.

For "PACHYPORA OR ALVEOLITES. (Sp. Undet.)"—read:

COENITES CRYPTODENS, Billings (Sp.)

Mr. Lambe is of the opinion that all the specimens referred to under the first of these headings, are referable to *Alveolites cryptodens*, Billings, which he thinks is a *Cœnites*.

Page 290.

For "PENTAMERUS COMIS, Owen"—read:

GYPIDULA COMIS, Owen (Sp.)

And, add to the list of synonyms and references:

Gypidula comis, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 247, fig. 177, pl. 72, figs. 15-24.

Page 291.

For "TEREBRATULA SULLIVANTI, Hall,"—read:

EUNELLA SULLIVANTI, Hall.

And, add the following reference:

Eunella Sullivanti, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pt. 290, fig. 210, pl. 80, figs. 23-26.

Page 331.

For "PLATYOSTOMA TUMIDUM. (N. Sp.)"—read:

PLATYOSTOMA WHITEAVESI, Miller.

Platyostoma tumidum, Whiteaves. 1892. This volume, pt. 4, p. 331, pl. 43, fig. 12. But not *Platyostoma tumidum*, Meek & Worthen, 1860.

Platyostoma Whiteavesi, S. A. Miller. 1897. Second Suppl. N. Amer. Geol. and Palæont., p. 769.

To the list of Pteropoda from the Devonian rocks of lakes Manitoba and Winnipegosis, on pages 342 and 343, add the following:

TENTACULITES PARVULUS. (N. Sp.)

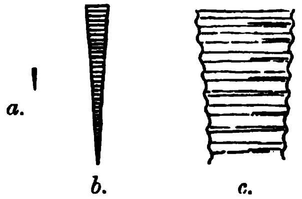

Fig. 5. *Tentaculites parvulus.* *a*, Side view of a specimen natural size; *b*, the same enlarged six times; and *c*, portion of the same, enlarged twenty-four times, to show the surface markings.

Shell (or rather cast of the interior of the shell) very small for the genus, averaging about three, and rarely exceeding three and a half millimetres in length, of the usual narrowly attenuate-conical shape. Surface of the cast marked by very numerous, close-set, minute annulations or transverse raised ridges, which are rather variable in their arrangement and proportionate size. In some specimens, or in different parts of the same specimen, they are either very close-set and uniform in size, or alternately a little larger and a little smaller, or of equal size but not quite so close together. Test unknown.

North side of Manitoba Island, J. B. Tyrrell, September 19, 1897; a flat piece of limestone of irregular shape but (roughly) about five inches by three, with its exposed and weathered surface strewn with numerous specimens of this species, which seems to be well characterized by its very diminutive size and close set, rib-like annulations. The lengths of the smallest of the Devonian species of *Tentaculites* described and figured by Hall in the second part of the fifth volume of the Palæontology of the State of New York, are stated to be as follows: *Tentaculites spiculus*, longest specimens, eight to ten millimetres, ordinary ones, four to six; *T. attenuatus*, ten to twelve mm., rarely a little more; *T. bellulus*, fifteen to twenty-two mm.

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*Now called Orthothetes.

†Now written Stropheodonta.

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PLATE I.

Unless otherwise stated, all the figures are of natural size.

Unio Albertensis (page 3).

Figure 1. Side view of the type specimen, shewing the left valve.

Anomia perstrigosa (page 4).

Figure 2. Upper valve of a perfect and well preserved specimen, as viewed from above.

Corbicula occidentalis (page 7).

Figure 3. Side view of a large specimen from Rye-Grass flat, shewing the right valve.

" 3*a*. The same as seen from above.

Corbicula obliqua (page 8).

Figure 4. Side view of a perfect specimen, from Rye-Grass flat.

" 4*a*. Dorsal aspect of the same.

" 4*b*. Cast of a left valve, with a slightly different outline, from the Belly River.

Corbula perangulata (page 9).

Figure 5. Side view of a somewhat arcuate example, from Rye-Grass flat.

" 5*a*. Dorsal view of the same, to shew the amount of convexity of the closed valves and the excavated posterior area.

" 5*b*. Side view of a younger specimen from the same locality. At this stage of growth the posterior area is not excavated and the posterior extremity is truncated.

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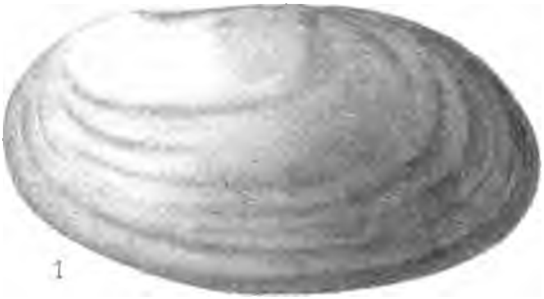
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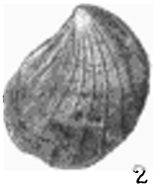
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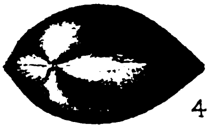
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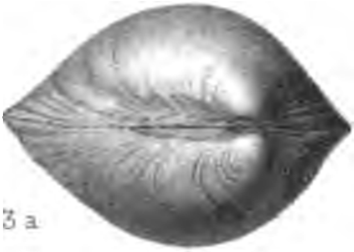
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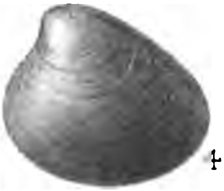
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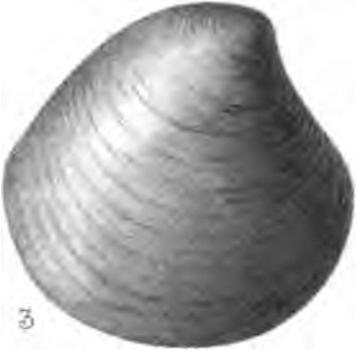
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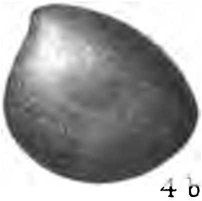
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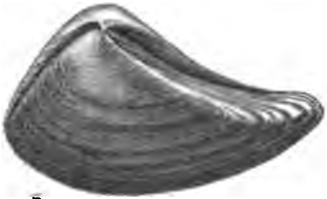
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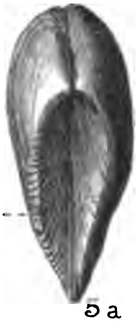
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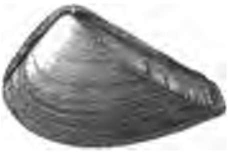
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PLATE II.

Corbula perangulata (page 9).

Figure 1. Side view of another adult specimen from Rye-Grass flat, of a shorter and less arcuate form than the one represented on plate 1, fig. 5.

Panopæa simulatrix (page 11).

Figure 2. The most perfect specimen collected, as viewed laterally.
" 2*a*. Dorsal view of the same.

Panopæa curta (page 12).

Figure 3. Side view of the type of this species, from Forks of Devil's Pine and Three Hills Creeks.

Physa Copei (page 14).

Figure 4. Dorsal view of a specimen from Pincher Creek, which has the apex broken off.
" 4*a*. Similar view of a smaller example of the same species, from Gooseberry Canon on the St. Mary River, in which the slender and acuminate spire is perfect.

Physa Copei, Var. Canadensis (page 14).

Figure 5. Dorsal view of a large and typical example of this variety, from Pincher Creek.
" 5*a*. Similar view of an unusually narrow variety of this shell, also from Pincher Creek, referred to on page 16 as approaching very nearly in shape to *Bulinus atavus*, White.
" 5*b*. Ventral view of another specimen from the same locality, to shew the characters of the aperture.

Patula angulifera (page 18).

Figure 6. The type and only specimen collected, as seen from above.
" 6*a*. Basal view of the same.
" 6*b*. Outline of the same from another point of view, to shew the comparative height of the shell and shape of the aperture.

Patula obtusata (page 18).

Figure 7. Upper side of the largest specimen known to the writer.
" 7*a*. Lower side of the same.
" 7*b*. Outline of the same to show the relative height or depth of the shell.

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PLATE II

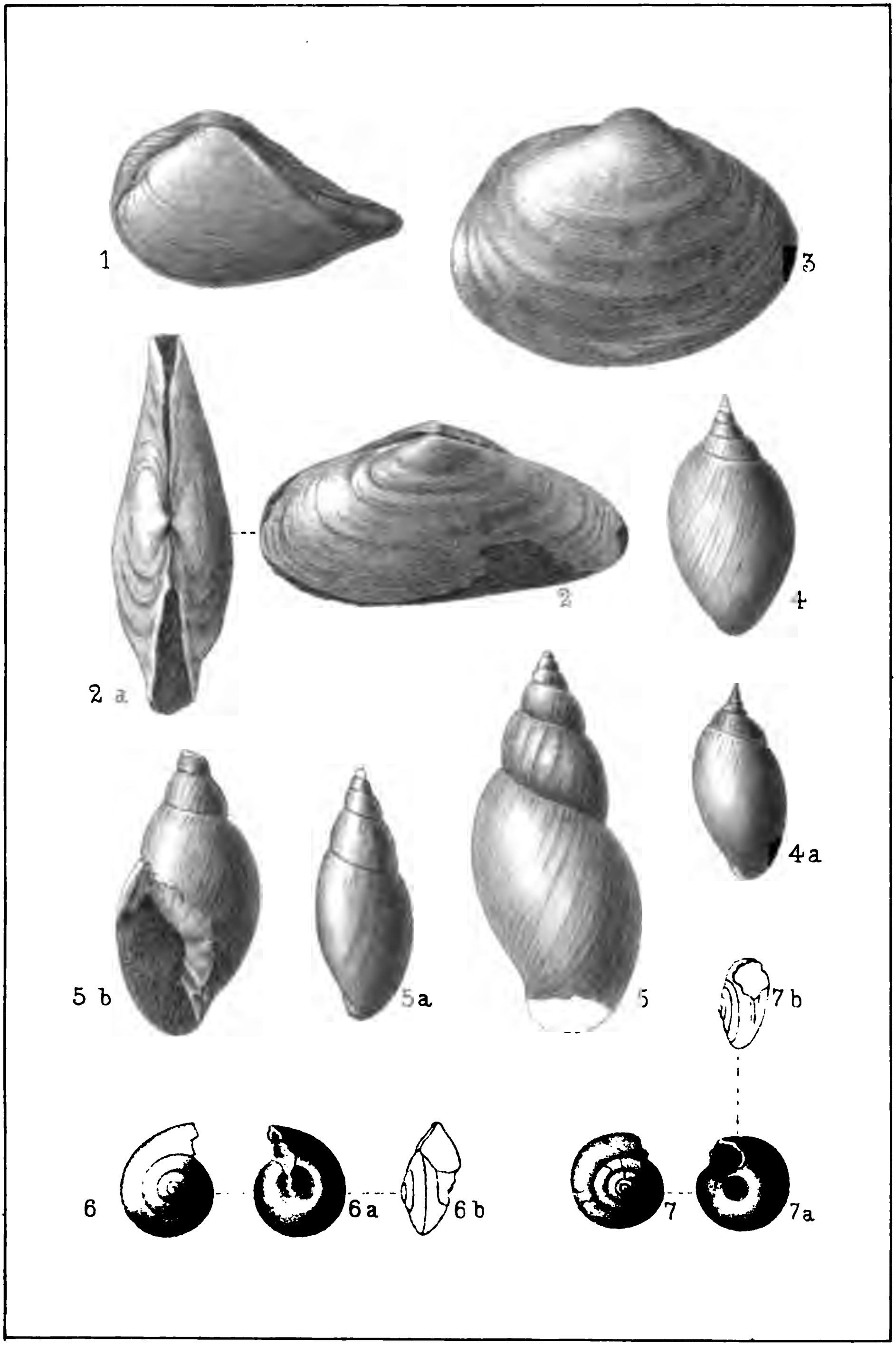

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PLATE III.

Acroloxus radiatulus (page 17).

Figure 1. The type specimen, from the mouth of the Blind Man River, as seen from above and slightly enlarged. The cross-lines to the right indicate the actual size.

" 1*a*. A portion of the surface of the same, still more highly magnified, to shew the details of the sculpture.

Anchistoma parvulum (page 19).

Figure 2. View of the upper side of the only specimen known.

" 2*a*. Basal view of the same.

" 2*b*. Another view of the same, to show the proportionate height or convexity of the shell, and the narrow lobe on the upper part of the outer lip.

Thaumastus limnæiformis (pages 20 and 27).

Figure 3. Dorsal view of a specimen of a supposed variety of this species, from the Rosebud River.

" 3*a*. Outline of another and apparently more typical specimen, from Wood End Depôt.

" 3*b*. Ventral view of the last, to shew the characters of the aperture.

Goniobasis Nebrascensis (page 21).

Figure 4. Dorsal view of a specimen from the St. Mary River.

" 4*a*. Portion of the same magnified, to shew the surface markings.

Goniobasis tenuicarinata (page 22).

Figure 5. Dorsal view of a specimen from the Bow River.

" 5*a*. Enlarged portion of the same, to shew the sculpture of the last volution of the spire.

Goniobasis tenuicarinata, Var., (page 22).

Figure 6. Specimen from Pincher Creek, dorsal view.

" 6*a*. Similar view of another and slightly distorted example from the same locality.

Valvata filosa (page 25).

Figure 7. Magnified representation of a perfect specimen from Pincher Creek, showing the upper surface. The cross-lines on the right indicate the actual size.

" 7*a*. Portion of the surface of the same, still more highly magnified, to shew the sculpture.

Valvata bicincta (page 25).

Figure 8. Specimen from the mouth of the Blind Man River, as seen from above, and considerably enlarged. The cross-lines between this and the next figure shew the actual size of the originals of both.

" 8*a*. Basal view of the same, also enlarged.

" 8*b*. A portion of the surface of the same specimen, still more highly magnified, to shew the details of the surface markings.

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PLATE III

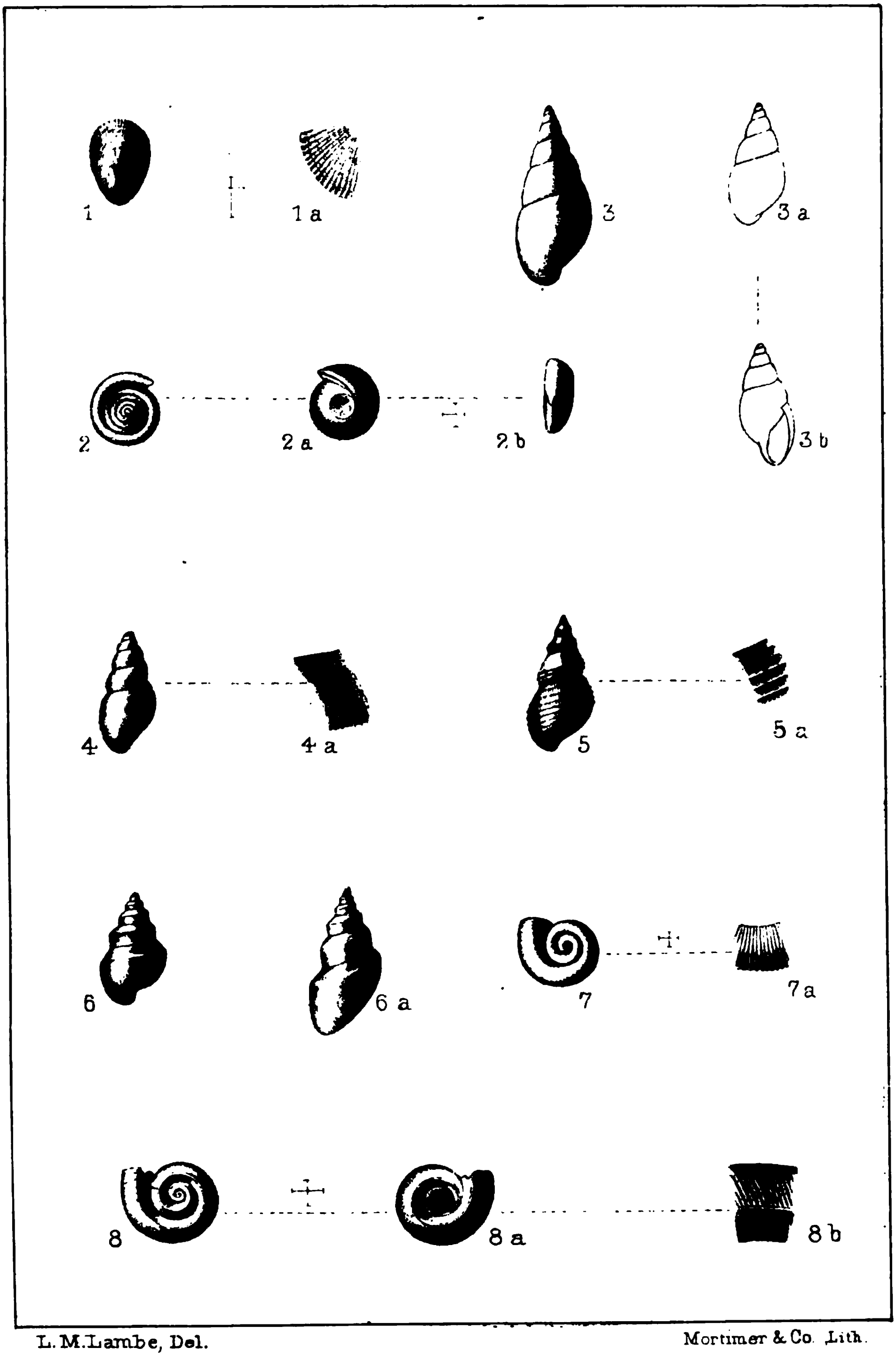

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PLATE IV.

Pteria (Pseudoptera) fibrosa, Var., (page 32).

Figure 1. Lateral view of a specimen from the Bow River, shewing the right valve.

Gervillia recta, Var. borealis (page 35).

Figure 2. Side view of a left valve from the Belly River.

" 2*a*. Cast of the interior of the closed valves, from the South Saskatchewan, shewing the impressions made by the muscular scars of the right valve.

" 2*b*. Interior of a fragment of a right valve, from the Belly River, which shews the cartilage pits of the anterior end of the hinge line.

Modiola (Brachydontes) dichotoma (page 37).

Figure 3. Lateral view of a right valve with the test preserved, from the St. Mary River. Considerably enlarged.

" 8*a*. Similar view of a cast of the interior of the closed valves of the shell of a larger and apparently more adult individual, from the same locality. Also considerably enlarged.

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PLATE IV.

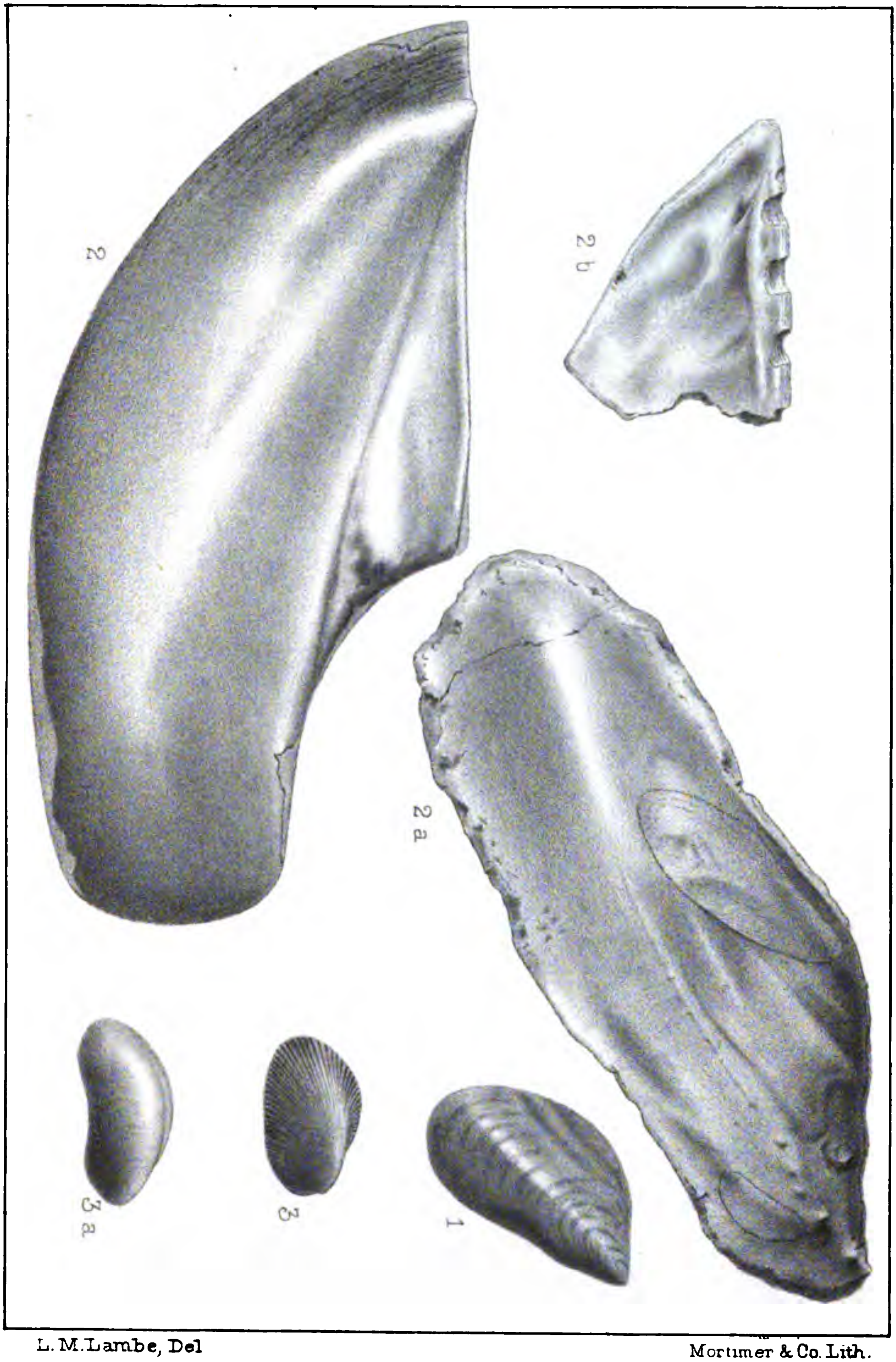

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PLATE V.

INOCERAMUS TENUILINEATUS (page 34).

Figure 1. Side view of a small but nearly perfect cast of the interior of this shell, from the South Saskatchewan, showing the shape and surface undulations of the left valve.

" 1*a*. The same as seen from above, to show the thickness through the closed valves.

YOLDIA SCITULA (page 38).

Figure 2. A right valve, slightly enlarged, with a portion of the outer surface still more highly magnified represented below. The cross-lines also below but a little to the right, indicate the actual size of the specimen.

CYPRINA OCCIDENTALIS, Var. ALTA (page 40).

Figure 3. Side view of a perfect left valve.

PROTOCARDIA SUBQUADRATA (page 41).

Figure 4. Side view of one of the most perfect specimens collected, shewing the right valve.

" 4*a*. Outline of the same as seen from above.

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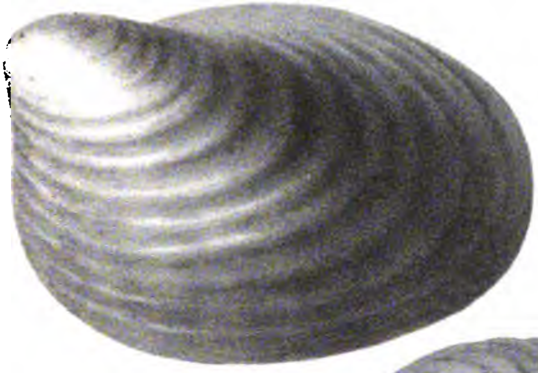
PLATE V



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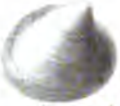

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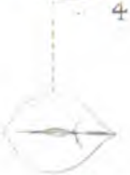

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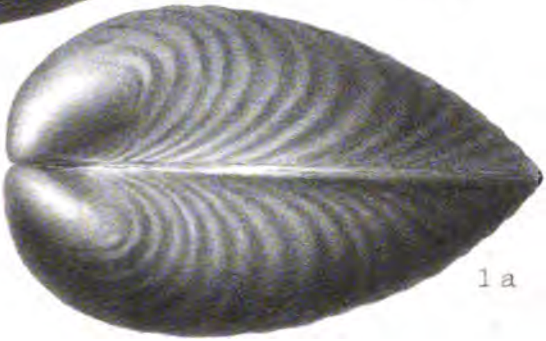

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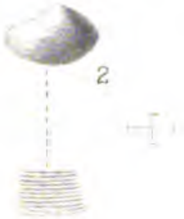

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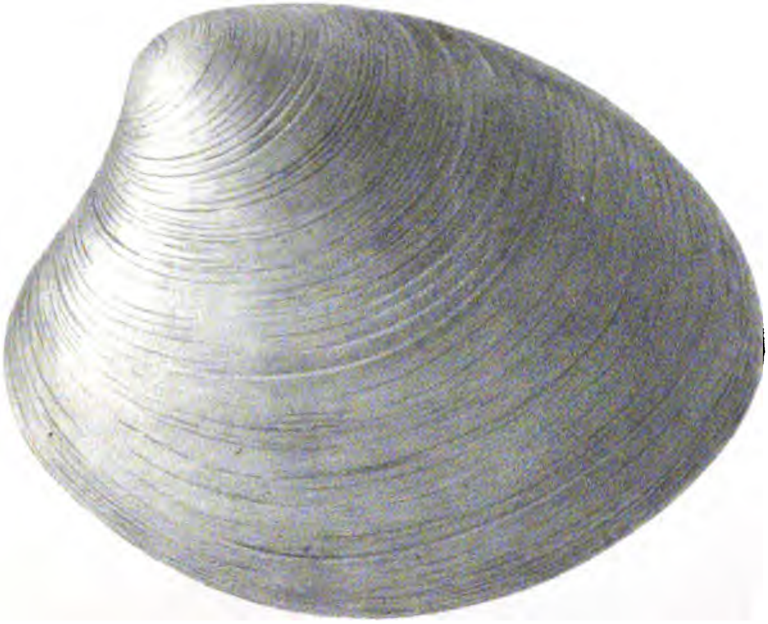

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PLATE VI.

Protocardia borealis (page 41.)

Figure 1.	Side view of a specimen of average size and normal form, shewing the right valve.
" 1*a*.	Dorsal outline of the same.
" 2.	Side view of another specimen, in which the valves are unusually tumid and inequilateral.
" 2*a*.	Dorsal outline of the last.
" 3.	Cast of the interior of a large specimen from Ross Coulée, shewing the outlines of the muscular impressions of the right valve.

Callista (Dosiniopsis) Deweyi (page 42).

Figure 4.	Side view of a supposed large variety of this species, from near Big Plume Creek, shewing the left valve.
" 5.	Outline of a cast of the interior of another form of the species, from Bull's Head, shewing the impressions of the pallial sinus and muscular impressions of the right valve.
" 5*a*.	Outline of portion of a left valve from the same locality as the last, to shew the hinge dentition of that valve.

Panopæa subovalis (page 44).

Figure 6.	Side view of the type specimen, shewing the right valve.
" 6*a*.	Outline of the same as seen from above, to illustrate the comparative convexity of the shell, the anterior and posterior gaping extremities, and the short ligamental area.

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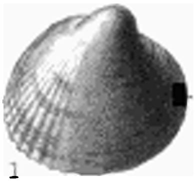
PLATE VI



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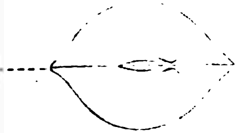

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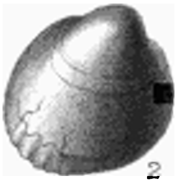

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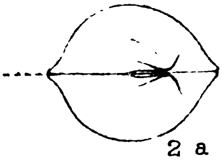

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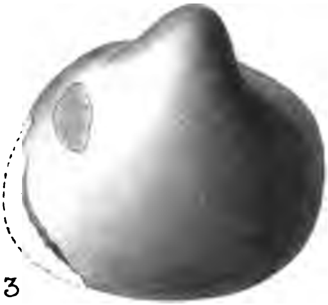

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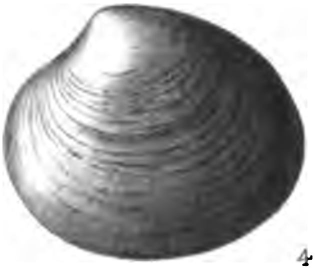

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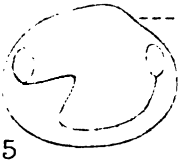

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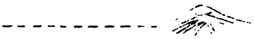

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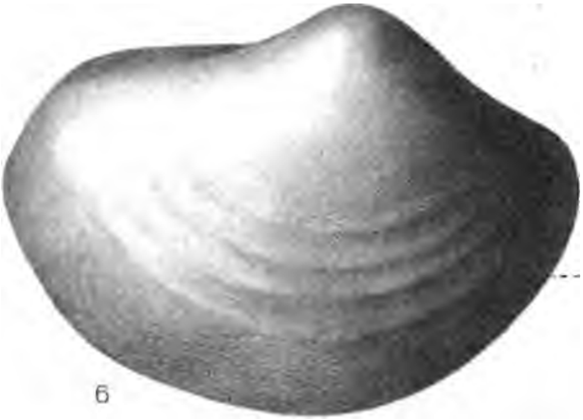

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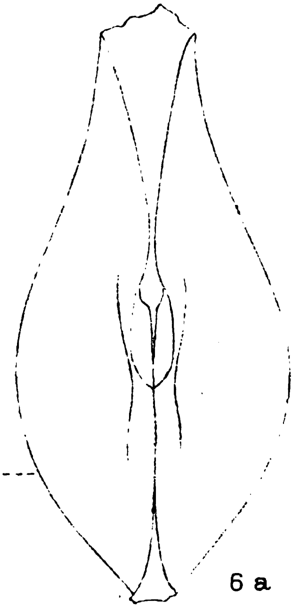

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L.M.Lambe del^{t}

Mortimer & Co. Lith.

PLATE VII.

ANISOMYON CENTRALE (page 47).

Figure 1. Side view of a specimen in which the apex is distinctly eccentric.

" 1*a*. The same as seen from above.

" 2. Side view of a specimen in which the apex is nearly central.

" 2*a*. Dorsal aspect of the last.

SCAPHITES SUBGLOBOSUS (page 52).

Figure 3. Side view of a large but entirely septate and worn specimen, from Old Wives Creek, in which the finer surface markings are partly obliterated. This species is more fully illustrated on the next plate.

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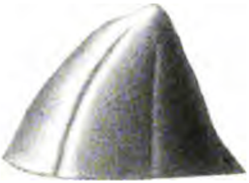
CONTR. TO CAN. PAL. VOL. I.　　PLATE VII.



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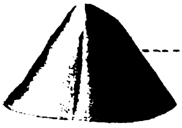

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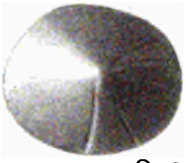

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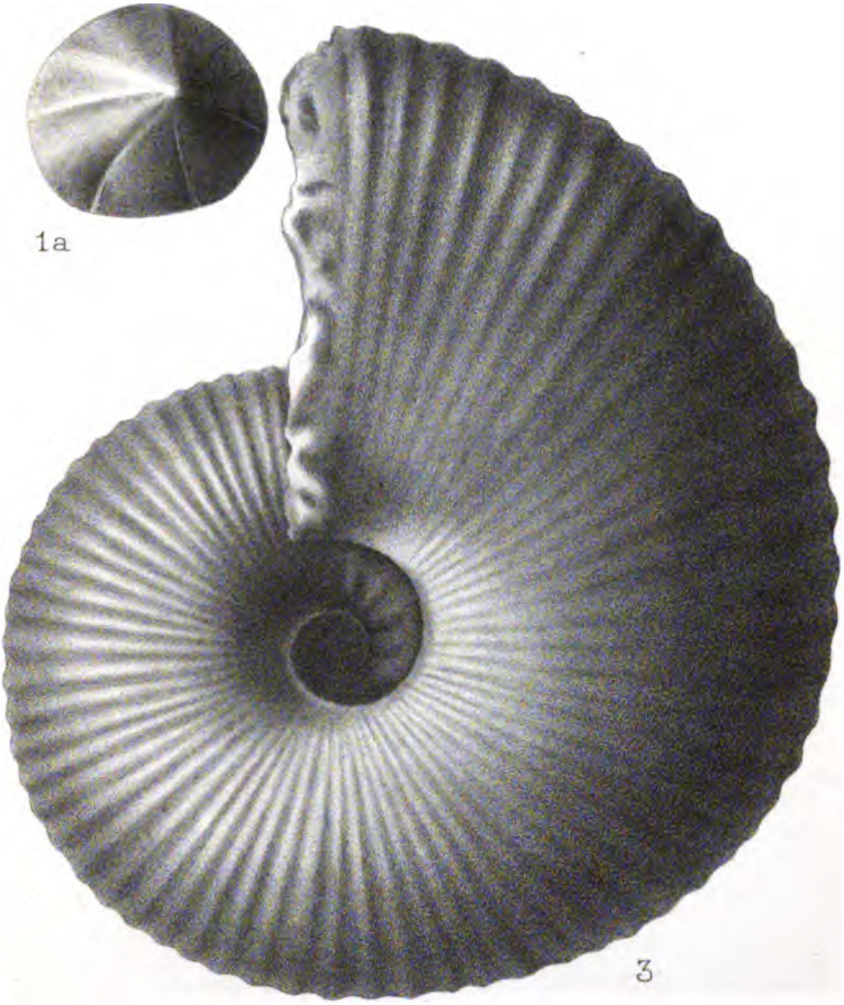

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L. M. Lambe. delᵗ　　Mortimer & Co. Lith.

PLATE VIII.

SCAPHITES SUBGLOBOSUS (page 52).

Figure 1.	Outline of the aperture of the specimen represented on plate VII., fig. 3, to shew the maximum convexity of the shell at that stage of growth.
" 1*a*.	Portion of a septum of the same specimen. The finer ramifications of the lobes and saddles are partly obliterated by erosion.
" 2.	Side view of a smaller but well preserved specimen, to shew the finer surface markings.
" 2*a*.	Outline of the aperture of the last.

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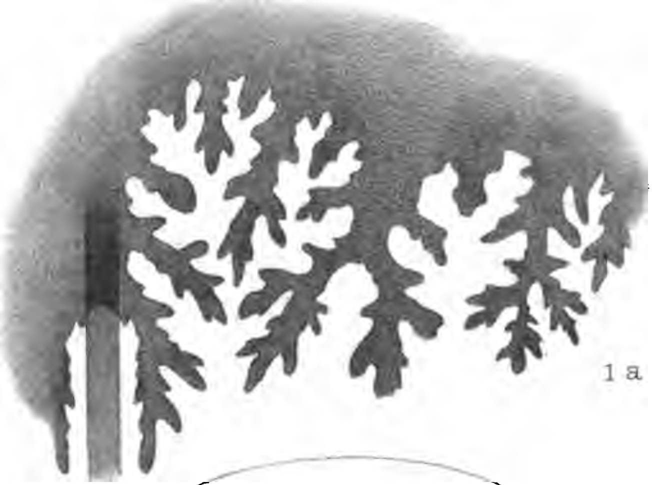

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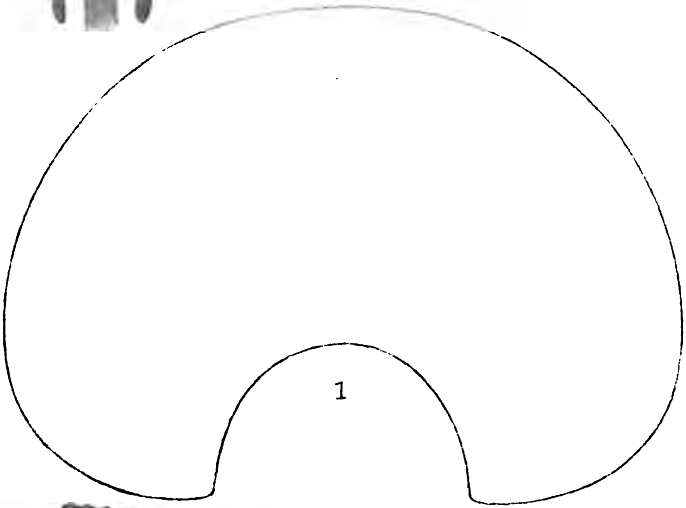

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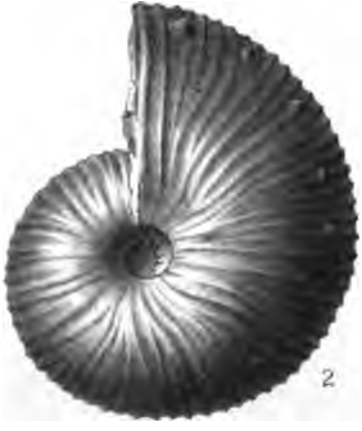

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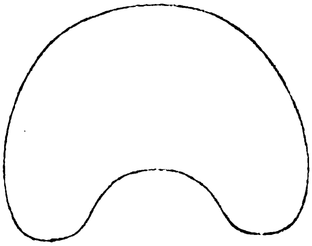

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L.M.Lambe del^t Mortimer & Co. Lith.

PLATE IX.

CRENELLA ? PARVULA (page 57).

Figure 1. Side view of a perfect right valve, much enlarged. The cross-lines below (to the right), indicate the exact size.

ANODONTA PROPATORIS (page 58).

Figure 2. Side view of a cast of the interior of a shell from near Bull's Head, which is doubtfully referred to this species, shewing the left valve.

" 2*a*. The same specimen as viewed from above.

SPHÆRIUM FORMOSUM, Var., (page 61).

Figure 3. Lateral outline of a right valve, considerably enlarged. The cross-lines to the right show the natural size of the specimen.

UNIO CONSUETUS (page 59).

Figure 4. Side view of the only perfect specimen collected.

" 4*a*. Dorsal aspect of the same.

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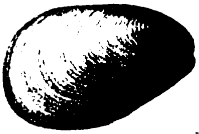
PLATE IX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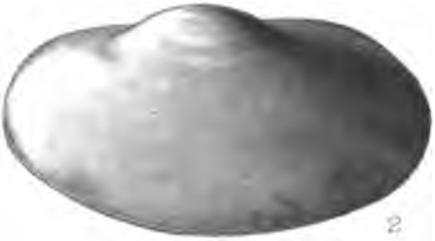
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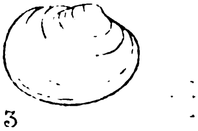
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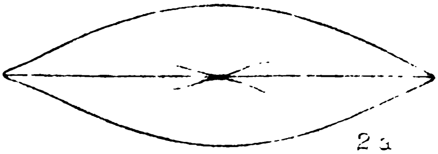
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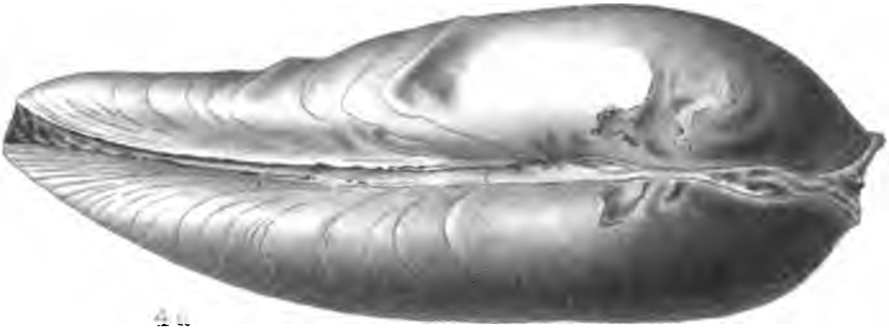
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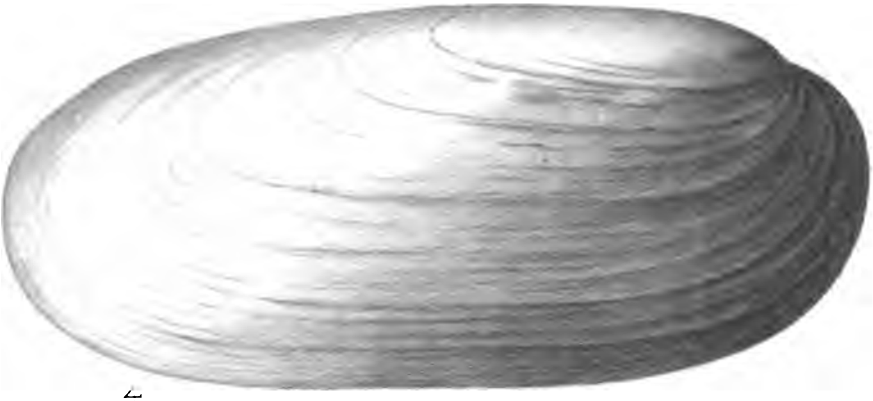
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Mortimer & Co Lith

PLATE X.

UNIO SUPRAGIBBOSUS (page 66).

Figure 1. Side view of a specimen, shewing the left valve.

UNIO SENECTUS (page 67).

Figure 2. Side view of a supposed small variety of this species, from the South Saskatchewan, shewing the right valve.

UNIO PRISCUS (page 65).

Figure 3. A very young but perfect specimen of a *Unio*, from the South Saskatchewan, which may be referable to this species, but which accords equally well with the characters of *U. vetustus*, Meek. The larger and more typical Canadian examples of *U. priscus* are not figured here, as the species has been well illustrated by Meek and Dr. C. A. White.

RYTOPHORUS (?) GLABER (page 69).

Figure 4. Dorsal view of a nearly perfect specimen with the test preserved.

" *4a.* Cast of the interior of the shell of a larger individual.

" *4b.* Half grown shell, with the apex broken off, to shew the sculpture of the body-whorl.

" 4c. A very young shell, much enlarged, to shew the narrowly acuminate spire and slender apical volutions at this stage of growth. The cross-lines to the right indicate the actual size.

PLANORBIS PAUCIVOLVIS (page 71).

Figure 5. Left side of the most perfect specimen known to the writer, much enlarged. The cross-lines to the right shew the natural size.

MELANIA (?) INSCULPTA (page 73).

Figure 6. Dorsal view of a nearly perfect specimen from the South Saskatchewan.

GONIOBASIS SUBTORTUOSA (page 74).

Figure 7. Dorsal view of a perfect and well preserved specimen, also from the South Saskatchewan.

HYDROBIA SUBCYLINDRACEA (page 75).

Figure 8. Ventral or "apertural" view of the type specimen, much enlarged.

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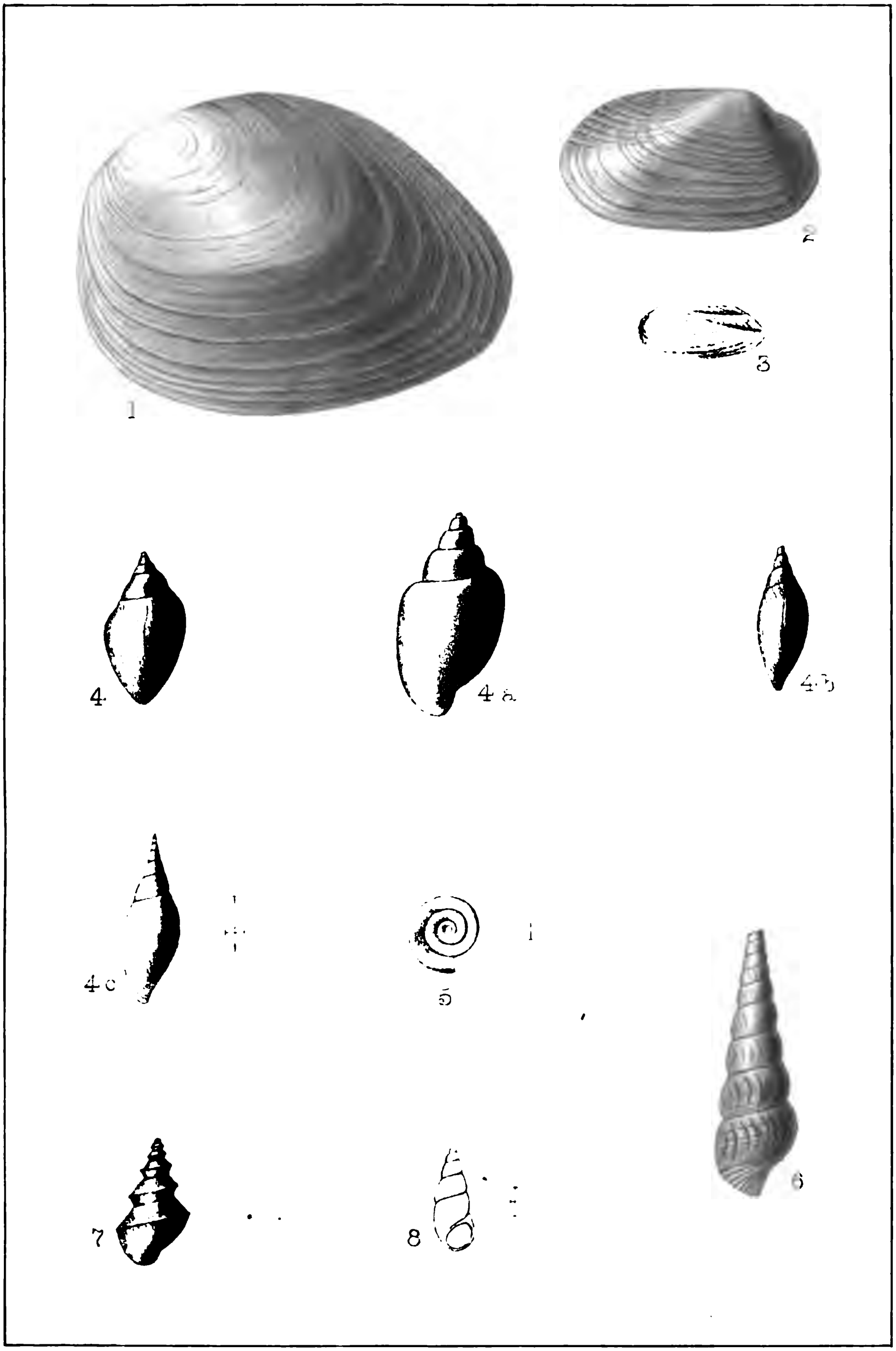

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PLATE XI.

Hoploparia (?) Canadensis (page 87).

Dorsal view of the type specimen.

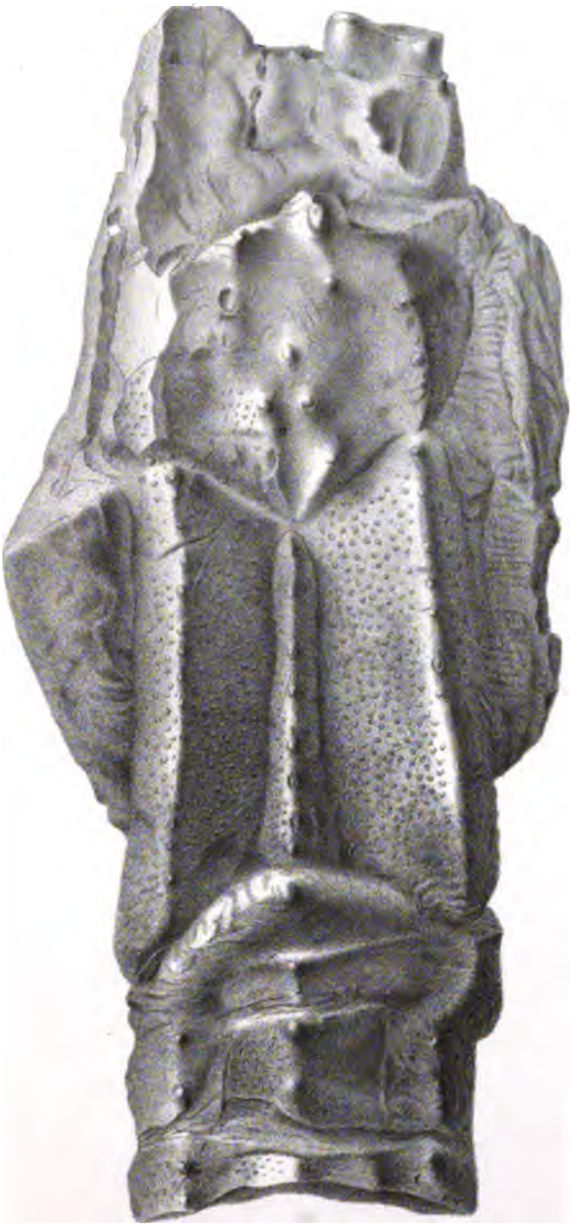

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PLATE XII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

Taxocrinus lobatus, var. (page 94).

Figure 1. Side view of the dorsal cup of a specimen from Thedford.

Homocrinus crassus (page 95).

Figure 2. Side view of the dorsal cup of the only specimen collected.

Dolatocrinus Canadensis (page 99).

Figure 3. Basal view of the dorsal cup of the type of this species. Twice the natural size.

Figure 3*a*. Summit view of the same specimen, shewing the dome plates. Twice the natural size.

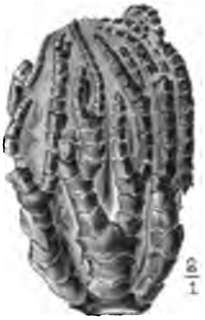
Figure 3*b*. Outline of the same, as viewed laterally.

Figure 3*c*. Diagram of plates of the dorsal cup of this species.

Columns of Dolatocrinus (page 101).

Figure 4. Portion of a column of a species of this genus, as seen from above.

Figure 4*a*. Lateral view of another portion of a similar column.



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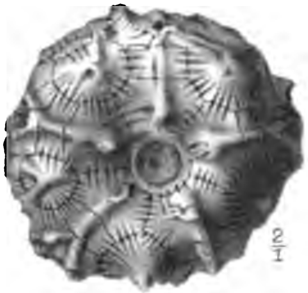

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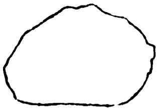

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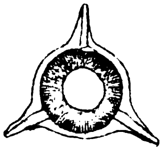

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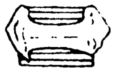

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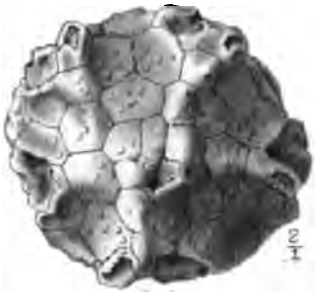

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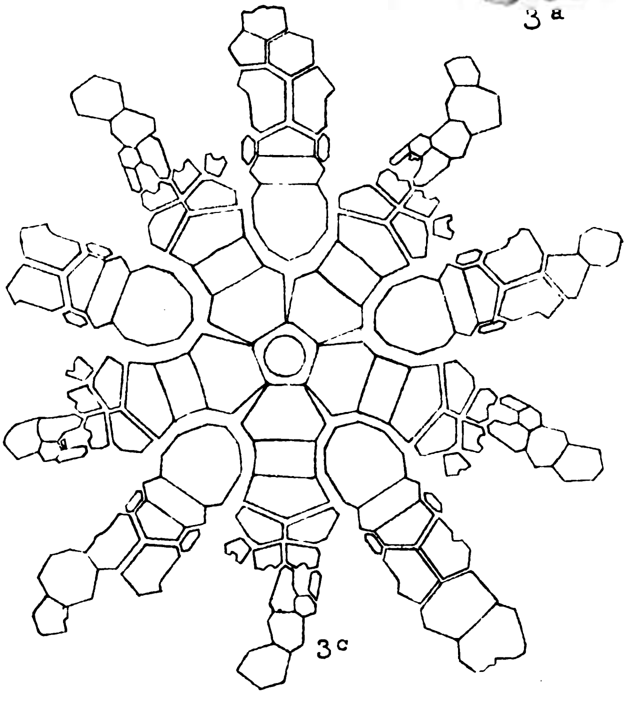

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PLATE XIII.

ARTHROACANTHA PUNCTOBRACHIATA (page 96).

Figure 1.	Side view of a specimen of the dorsal cup of this species, from Bartlett's Mills.
Figure 1*a*.	Similar view of another specimen from the same locality, in which the summit is completely filled by a *Platyceras*.

MEGISTOCRINUS, SP. INDT. (page 101).

Figure 2.	Side view of the central dome plate.
Figure 2*a*.	End " " " " "
Figure 2*b*.	Basal " " " " "

SPINE OF DOME OF CRINOID (page 102).

Figure 3.	Side view of the spine.
Figure 3*a*.	Basal view of the same.

OLLACRINUS SPINIGERUS (page 103).

Figure 4.	Side view of an unusually perfect specimen from Thedford.
Figure 4*a*.	The same, as seen from above, shewing the dome plates.
Figure 4*b*.	The same, as seen from below.

All enlarged four times.

ANCYROCRINUS BULBOSUS (page 103).

Figure 5.	Side view of a worn specimen of the root and part of the column of this species.

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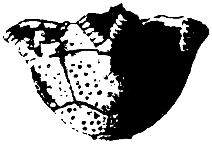
PLATE XIII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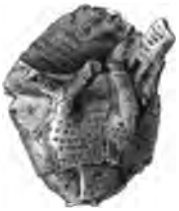
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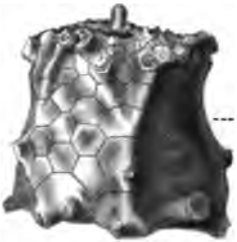
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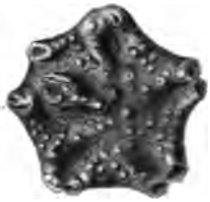
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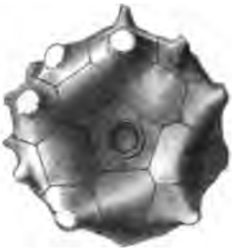
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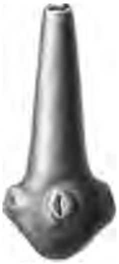
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A. Mortimer, Lith.

PLATE XIV.

Pentremitidea filosa (page 104).

Figure 1.	Side view of the most perfect specimen collected. Twice the natural size.
Figure 1*a*.	Outline of the same specimen, as seen from above. Twice the natural size.
Figure 1*b*.	Outline of a portion of the summit of the same. Four times the natural size.

Nucleocrinus elegans (page 107).

Figure 2.	Outline of the summit plates of a Canadian specimen. Much enlarged.

Granatocrinus Leda (page 108).

Figure 3.	Side view of a specimen from Thedford.
Figure 3*a*.	The same specimen as seen from above.
Figure 3*b*.	One of the radial plates of the same. Twice the natural size.
Figure 3*c*.	A portion of the surface of the radial plate figured, still further enlarged, to show the minute details of the sculpture.
Figure 3*d*.	One of the deltoid plates of the same specimen. Three times the natural size.
Figure 3*f*.	Diagram of the calyx plates of a Canadian specimen of this species.

Codaster Canadensis (page 109).

Figure 4.	Lateral view of a specimen from Thedford.
Figure 4*a*.	The same, as seen from above.

Both twice the natural size.

Eleutherocrinus Cassedayi (page 110).

Figure 5.	Radial view of the most perfect specimen yet collected in Canada.
Figure 5*b*.	View of the opposite side of the same, shewing the large and unforked azygos lateral, with the paired basals below it, in the centre, and a partly modified radial on each side.
Figure 5*a*.	Summit view of the same, shewing the four regular ambulacra, and the modified azygos one, &c.

All twice the natural size.

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PLATE XIV

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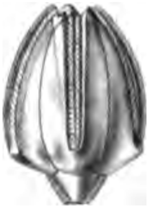

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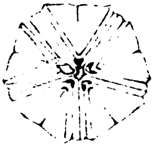

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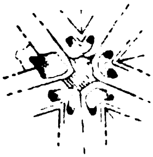

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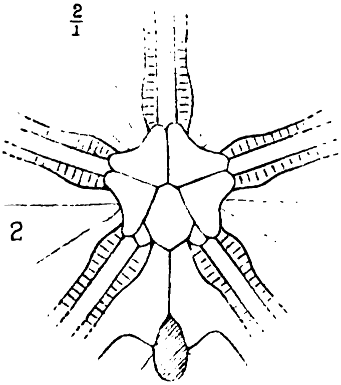

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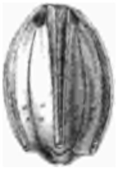

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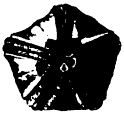

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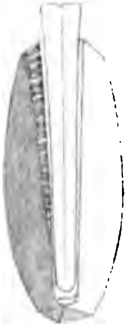

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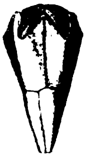

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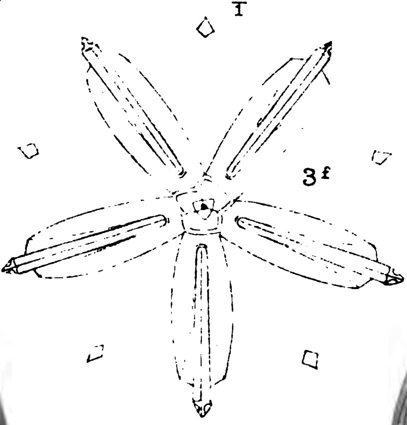

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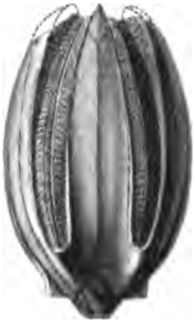

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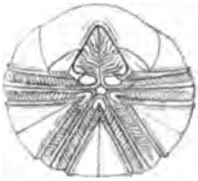

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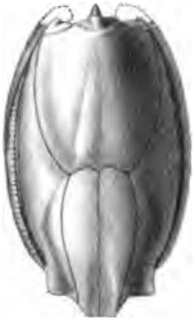

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L. M. Lambe, Del.

A. Mortimer, Lith.

PLATE XV.

LINGULA THEDFORDENSIS (page 111).

Figure 1. Side view of the type of this species. Twice the natural size.

STROPHALOSIA PRODUCTOIDES (page 112).

[Referred to in the text in connection with *Productella* (*Strophalosia*) *truncata*, Hall.]

Figure 2. View of a specimen of this species from the Athabasca River, shewing the exterior of the ventral valve.

Figure 2*a*. Opposite side of the same specimen, shewing the exterior of the dorsal valve and the hinge areas of both.

Both three times the natural size.

SPIRIFERA SUBDECUSSATA (page 114).

Figure 3. View of the type of this species, shewing the dorsal valve and the hinge area of the ventral. Natural size.

Figure 3*a*. A portion of the surface of the same, enlarged, to shew the finer details of the sculpture.

GRAMMYSIA ARCUATA ? Var. (page 116).

Figure 4. View of the cast of the interior of the left valve, referred to in the text as having been collected by Mr. J. Pettit.

PLATYCERAS QUINQUESINUATUM (page 117).

Figure 5. Side view of a specimen of this species from Thedford.

Similar view of another specimen from the same locality.

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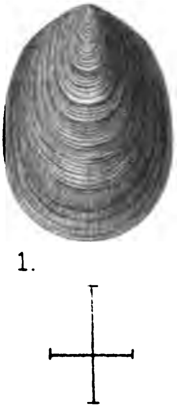

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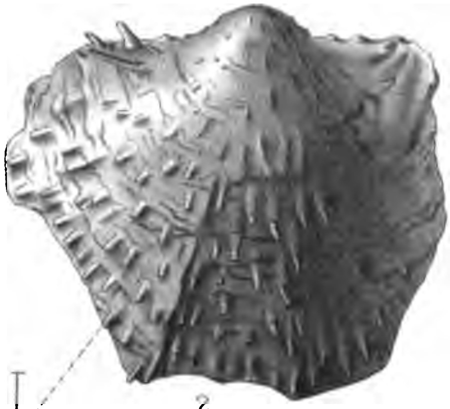

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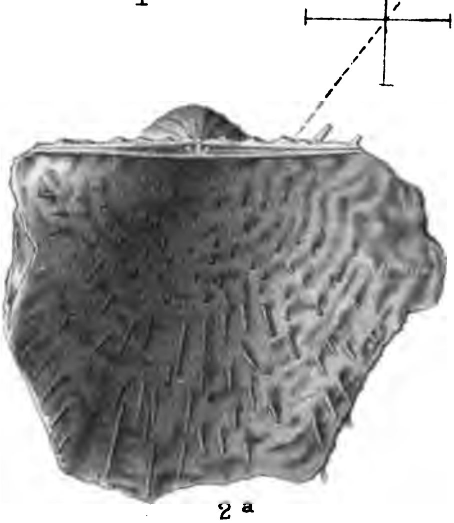

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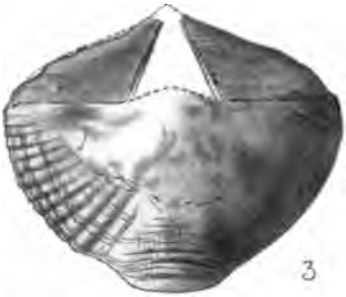

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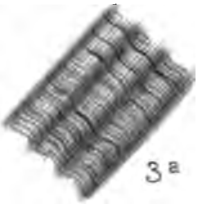

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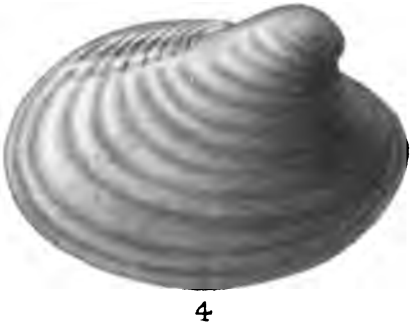

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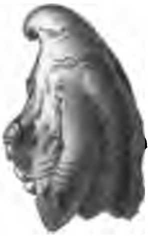

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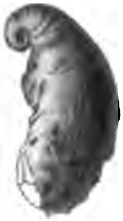

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PLATE XVI.

PRODUCTELLA (STROPHALOSIA?) TRUNCATA (page 112).

Figure 1. Specimen of this species, shewing the exterior of the ventral valve.

Figure 2. Similar view of another specimen.

Both figures are twice the natural size. The outlines on the side of each figure are intended to shew the contour of the closed valves and the exact dimensions of each specimen.

TURBO SHUMARDI (page 116).

Figure 3. Dorsal view of a specimen of this species, from the Township of Bosanquet.

PLATYCERAS (ORTHONYCHIA) CONICUM (page 117).

Figure 4. Lateral view of a specimen of this species, from Thedford.

PLATYCERAS QUINQUESINUATUM (page 117).

Figure 5. Apertural view of a specimen from Thetford.

PLATYOSTOMA PLICATUM (page 118).

Figure 6. Dorsal view of the type of this species.

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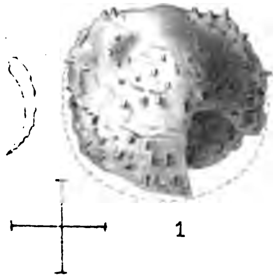

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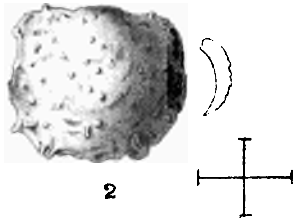

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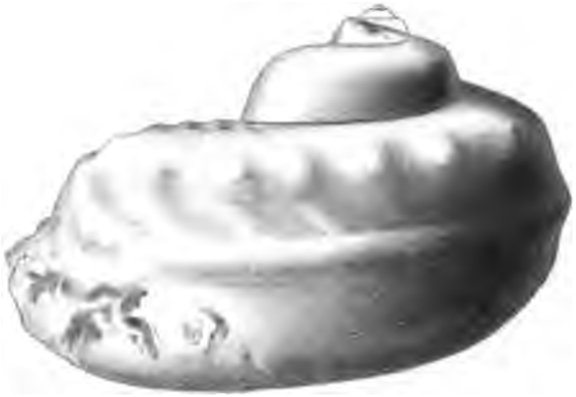

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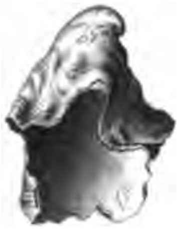

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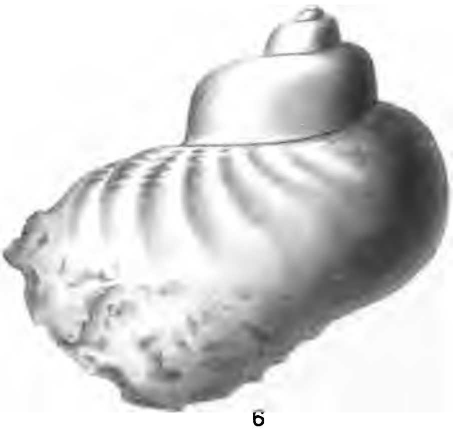

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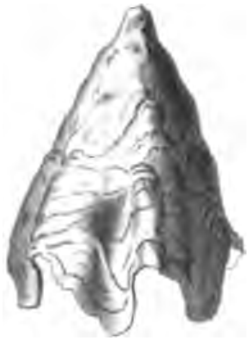

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L. M. Lambe Del. A. Mortimer, Lith.

PLATE XVII.

Spiriferina borealis (page 128).

Figure 1.	Dorsal view of the type of the species.

Terebratula Liardensis (page 130.)

Figure 2.	Dorsal view of one of the most perfect specimens of the narrowly ovate and most usual form of this species.
Figure 2*a*.	Profile view of the same specimen, in outline only.
Figure 2*b*.	Front view of the same, also in outline only.
Figure 2*c*.	Dorsal view of a broad and nearly circular form of the species.

Monotis subcircularis (page 131).

Figure 3.	Right valve of an obliquely subovate specimen of this species, from Fossil Point on the Peace River.
Figure 3*a*.	Right valve of another specimen, of more nearly circular outline, from the same locality.

Monotis ovalis (page 132).

Figure 4.	Left valve of the type of this species.

Halobia occidentalis (page 134).

Figure 5.	Left valve of the type specimen.
Figure 6.	Small piece of rock, partly covered by the basal portion of a left valve and a nearly entire right valve of a shell which is somewhat doubtfully referred to this species.

Trigonodus (?) productus (page 135).

Figure 7.	Right valve of a specimen of this species.
Figure 7*a*.	Left valve of another specimen, from the same locality.
Figure 7*b*.	Dorsal view of the closed valves of a third specimen, in outline only.

All the figures twice the natural size.

Margarita Triassica (page 136).

Figure 8.	Dorsal view of one of the most perfect specimens collected.
Figure 8*a*.	Basal view of the same.

Both figures three times the natural size.

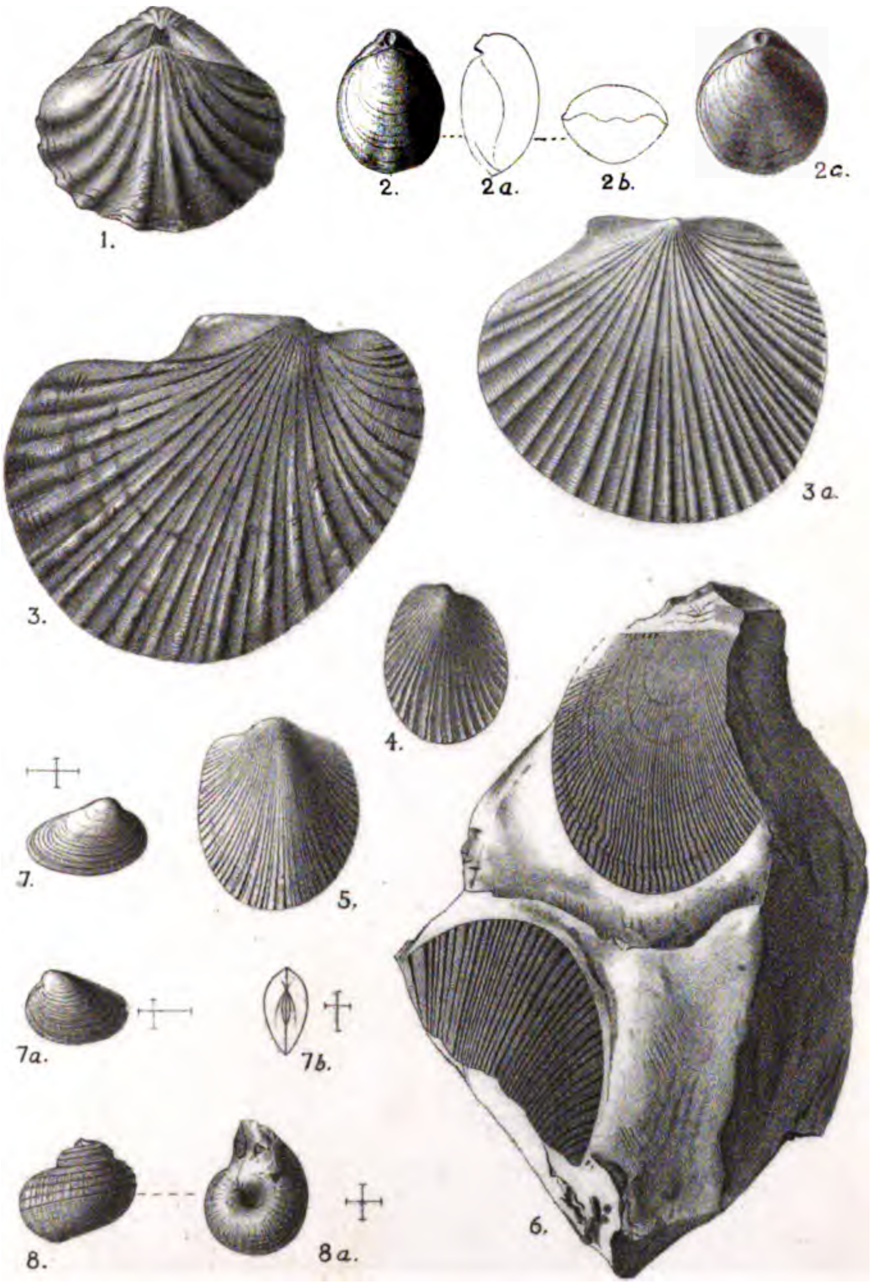

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PLATE XVIII.

Nautilus Liardensis (page 137).

Figure 1. Side view of the type of this species.
Figure 1*a*. Front view of the same specimen.

Popanoceras McConnelli (page 138.)

Figure 2. Side view of a specimen of the *typical form*.
Figure 2*a*. Front view of the same specimen, in outline.
Figure 2*b*. Portion of the sutural line of another specimen.
Figure 3. Side view of a specimen of the *variety lenticulare*.
Figure 3*a*. Front view of the same, in outline.

Trachyceras Canadense (page 142).

Figure 4. Side view of the type of this species.
Figure 4*a*. Front view of the same, showing the groove in the centre of the abdominal region.
Figure 4*b*. Portion of the sutural line of the same specimen.

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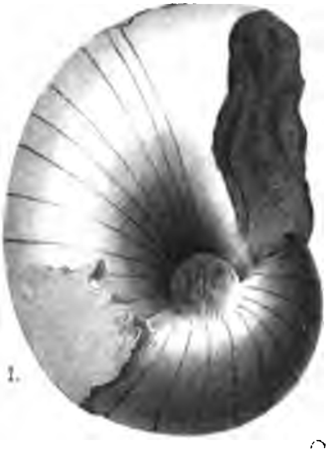
PLATE XVIII



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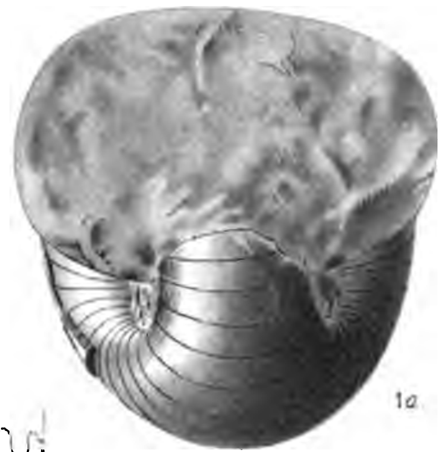

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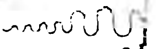

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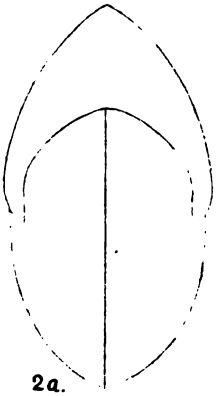

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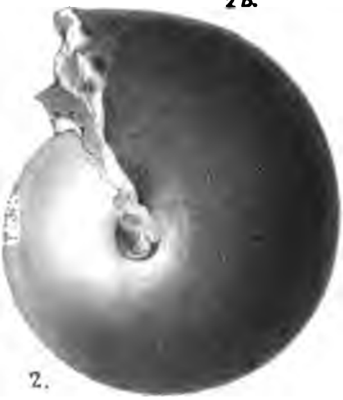

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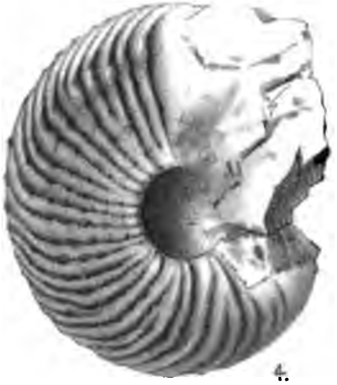

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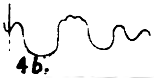

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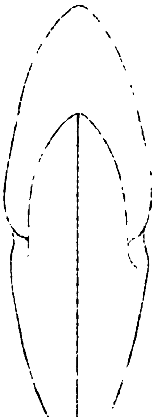

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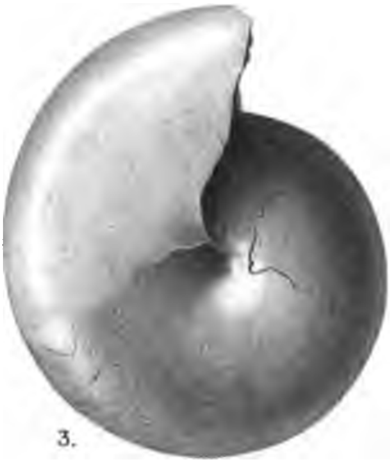

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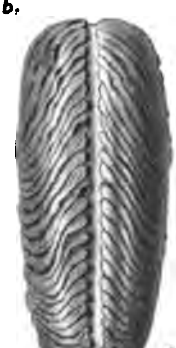

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PLATE XIX.

ACROCHORDICERAS (?) CARLOTTENSE (page 141).

Figure 1. Side view of the larger of the two fragments upon which this species is based. The dotted lines indicate the probable outline of the shell.

ARNIOTITES VANCOUVERENSIS (page 146).

Figure 2. Side view of the type of this species and genus, from Crescent Inlet.

ARNIOTITES. Species uncertain. (Page 147).

Figure 3. Side view of the largest and most perfect specimen from Robson Island described on page 147.

ARNIOTITES or CELTITES. Species uncertain. (Page 147).

Figure 4. Side view of the large specimen from Forward Inlet, referred to on page 147.

BADIOTITES CARLOTTENSIS (page 148).

Figure 5. Side view of the type of this species from Houston Stewart Channel, Q.C.I. Four times natural size.

AULACOCERAS CARLOTTENSE (page 149).

Figure 6. Guard of the most perfect specimen known, of this species, also from Houston Stewart Channel, Q.C.I.

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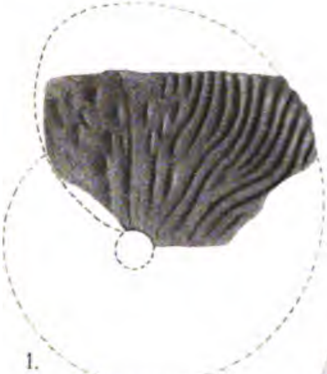
PLATE XIX



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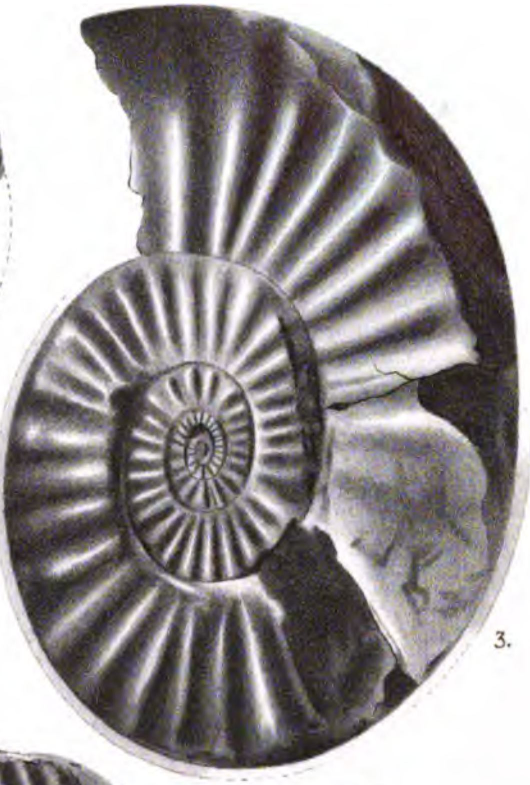

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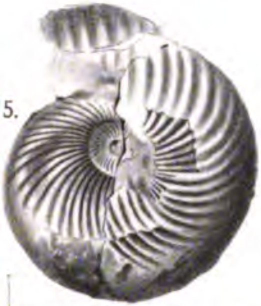

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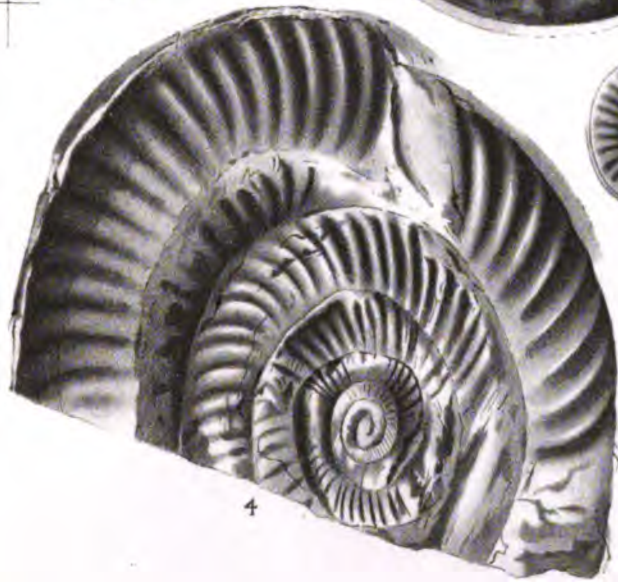

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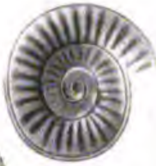

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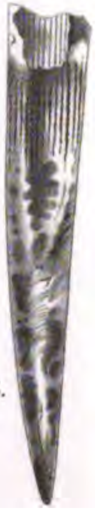

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Mortimer, Lith

PLATE XX.

PLACENTICERAS (PEREZIANUM ? var.) LIARDENSE (page 158).

Figure 1. Side view of a small but nearly perfect specimen of this shell, from the Liard River near old Fort Halkett.

Figure 2. Side view of a fragment of a large specimen of the same species, and from the same locality.

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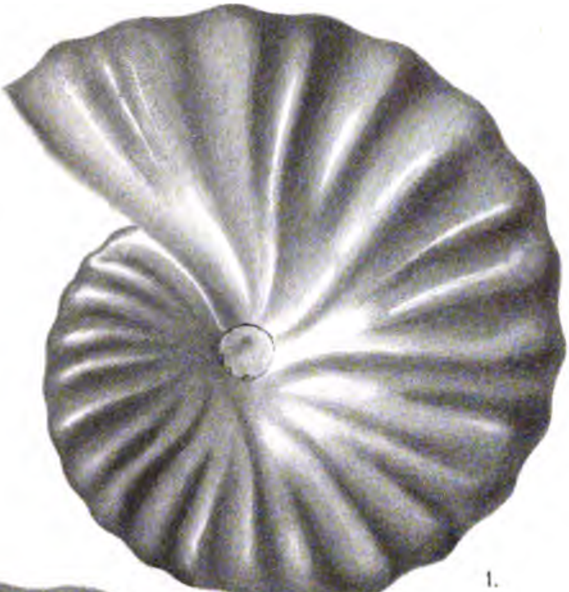

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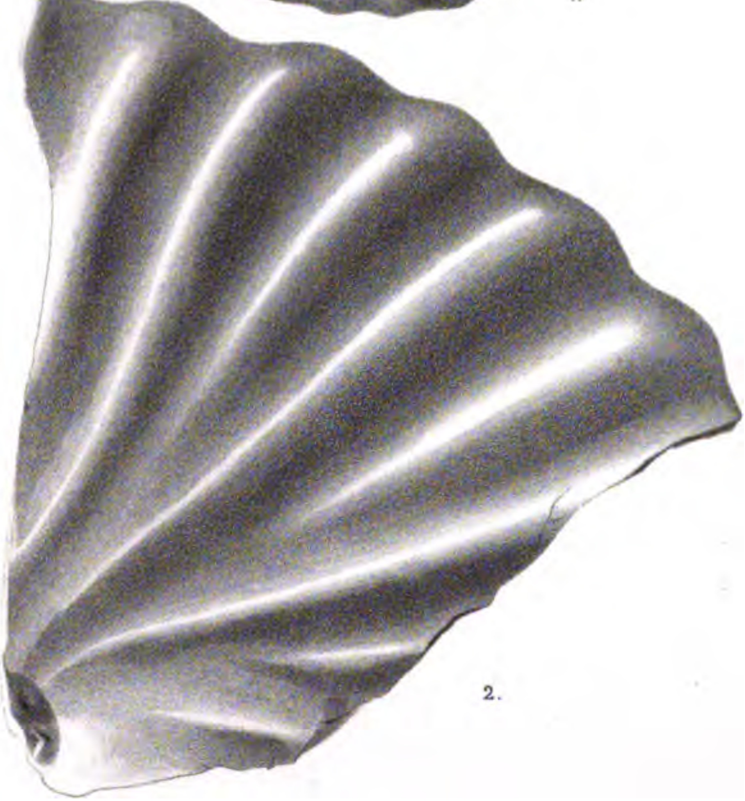

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PLATE XXI.

PLACENTICERAS OCCIDENTALE (page 155).

Figure 1. Side view of the type of this species from the K-uk River, B.C.

SCAPHITES QUATSINOENSIS (page 158).

Figure 2. Side view of the most perfect specimen of this species yet collected, from the east side of Winter Harbour, Quatsino Sound.

DISCINA PILEOLUS (page 159).

Figure 3. View of the most perfect of the two dorsal valves collected, as seen from above.

Figure 3*a*. Lateral view of the same, in outline only, to shew the relative height of the valve.

CYPRINA YUKONENSIS (page 160).

Figure 4. Side view of a right valve of this species.

SCHLOENBACHIA BOREALIS (page 160).

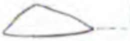
Figure 5. Side view of the largest and most perfect specimen of this species yet collected.

Figure 6. View of an *Aptychus* found associated with *S. borealis.*

ESTHERIA BELLULA (page 162).

Figure 7. Side view of the type of this species. Twice natural size.

Figure 7*a*. Side view of the left valve of a shell supposed to be referable to *E. bellula.* Twice natural size.



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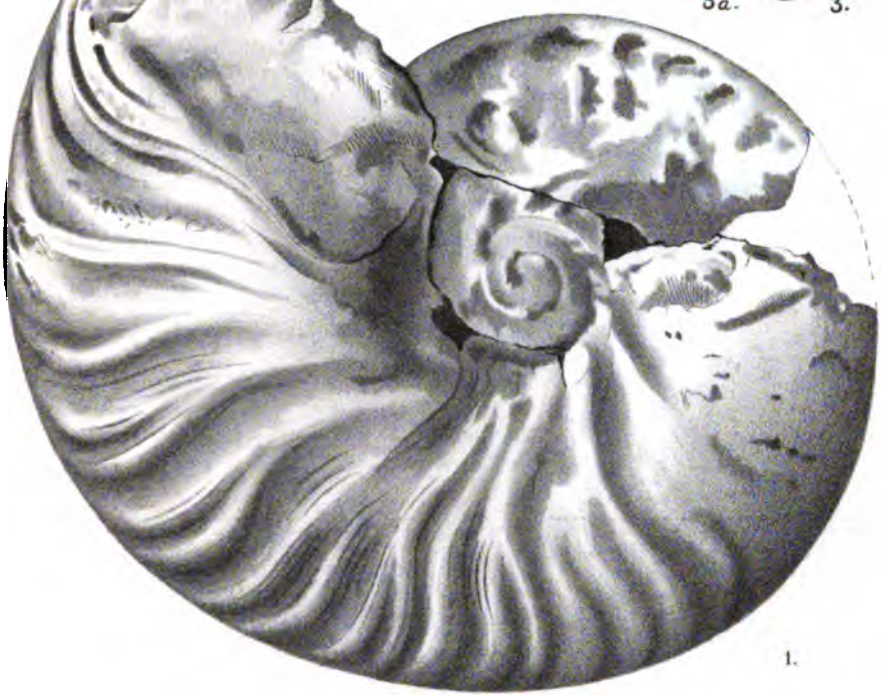

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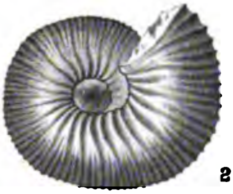

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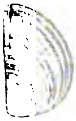

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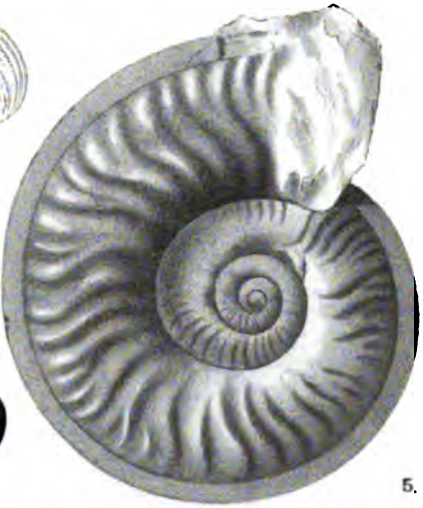

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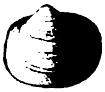

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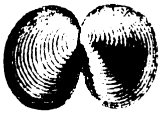

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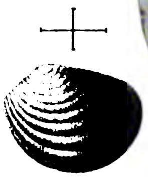

7.a

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Mortimer, Lith.

PLATE XXII.

TEREBRATULA ROBUSTA (page 163).

Figure 1. View of a rather narrowly elongated form of this species, showing the whole of the dorsal valve and part of the ventral.

Figure 1*a*. Profile view of the same specimen, in outline only.

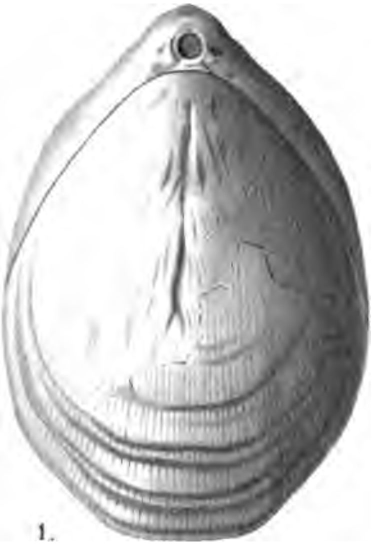
Figure 1*b*. Front view of the same, also in outline only, to show the slight mesial fold and sinus.

Figure 2. View of a comparatively broad and short form of the species, shewing the whole of the dorsal valve and part of the ventral.

LIMA PEROBLIQUA (page 165).

Figure 3. Side view of the most perfect specimen (a cast of the interior of a left valve) yet collected.

Figure 3*a*. Fragment of a left valve with part of the test preserved, to shew the surface ornamentation.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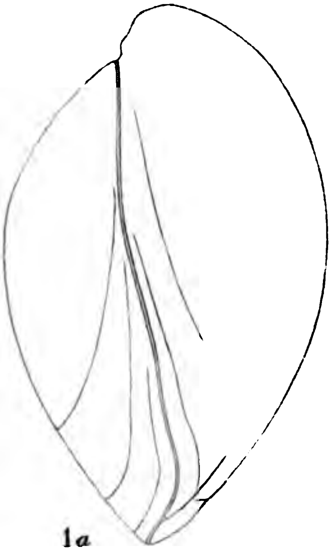
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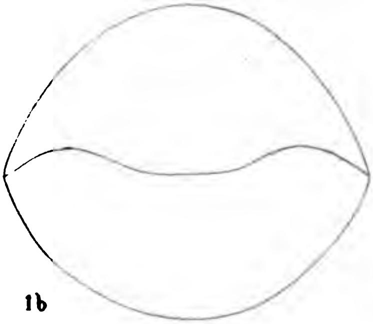
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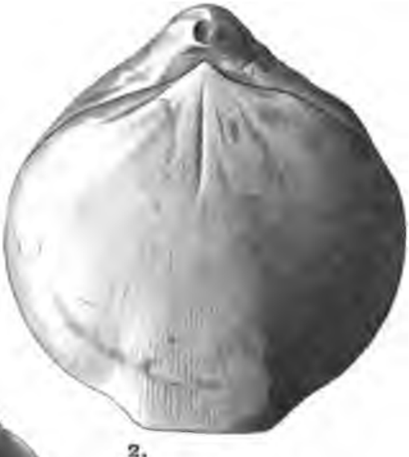
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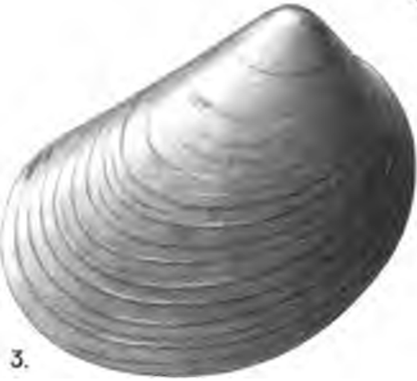
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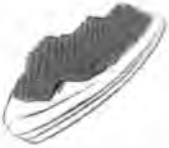
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L. M. Lambe, Del. Mortimer, Lith.

PLATE XXIII.

Pteria (Oxytoma) Cornueliana (page 166).

Figure 1.	Side view of a large and nearly perfect left valve, from the Rocky Mountains three miles north of the east end of Devil's Lake.
Figure 1*a*.	An imperfect right valve from the same locality.
Figure 1*b*.	Outline of another left valve from the same locality.

Schlœnbachia gracilis (page 171).

Figure 2.	Side view of the type of this species.
Figure 2*a*.	Outline of the aperture of the same specimen. The unbroken line shews the breadth of the aperture at the summit of one of the ribs, and the dotted line the thickness of the shell in the interval between two of the ribs.

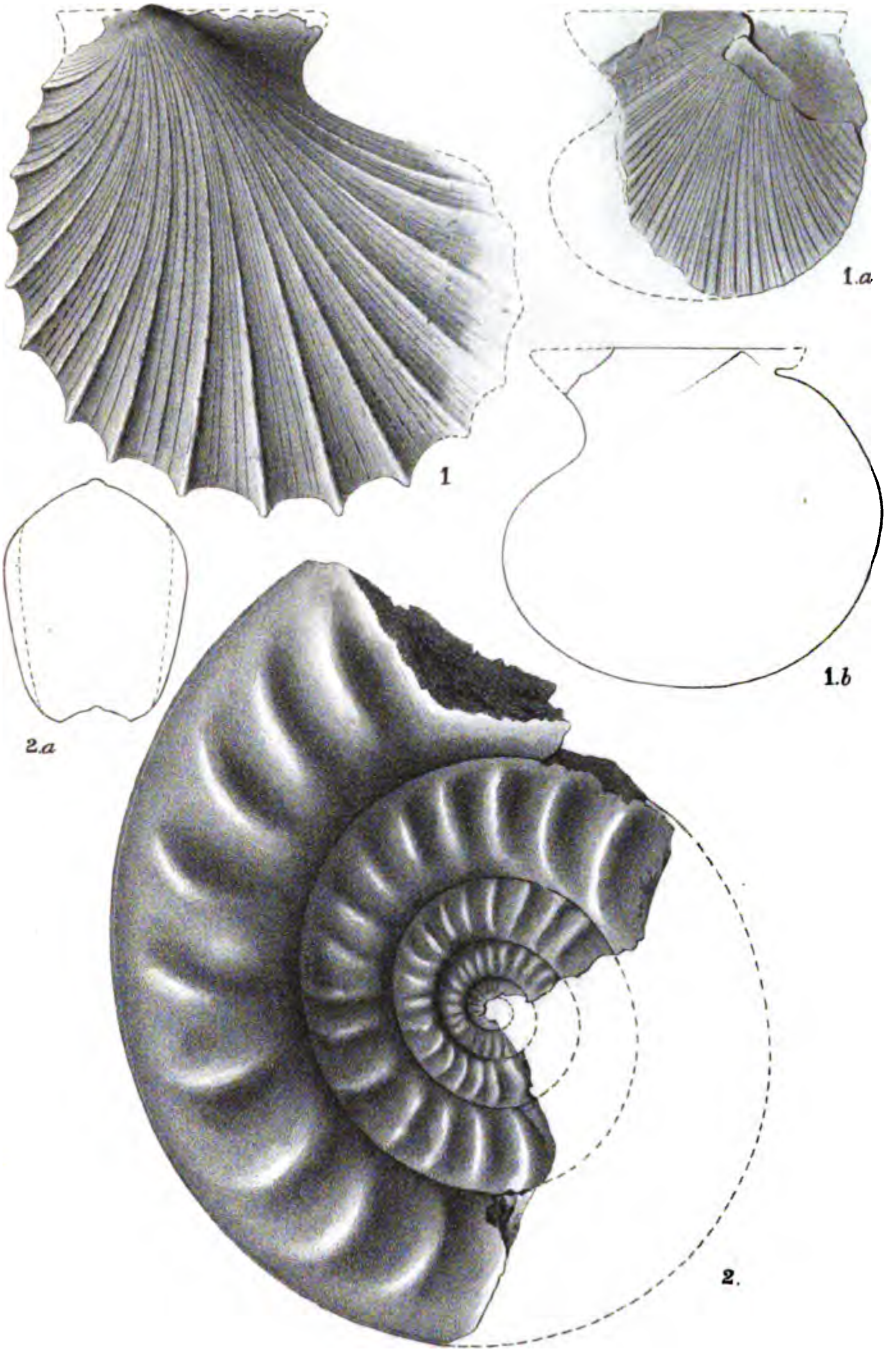

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PLATE XXIV.

Placenticeras glabrum (page 172).

Figure 1.	Side view of the type of this species.
Figure 1*a*.	Front view of the same specimen, in outline.
Figure 1*b*.	One side of a sutural line of the same.

Cyprina subtrapeziformis (page 176).

Figure 2.	Side view of the most perfect specimen collected, with the test preserved and shewing the right valve.
Figure 2*a*.	Similar view of a cast of the interior of a shell of this species, shewing the shape of the pallial line and muscular impressions in the right valve.
Figure 2*b*.	Side view of another cast of the interior of a shell of this species, of somewhat different shape to the last.

Linearia formosa? (page 177).

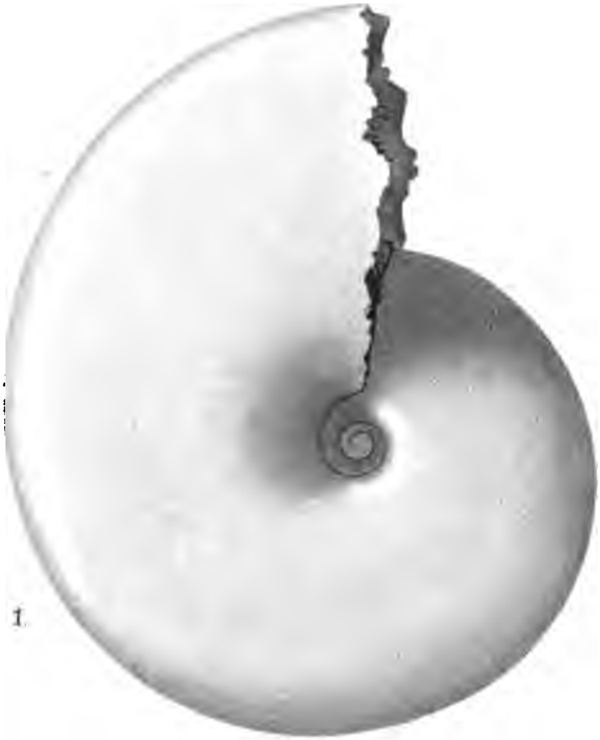
Figure 3.	Side view of a perfect right valve of a shell which is supposed to be referable to this species. Twice the natural size.

Solecurtus (Tagelus) occidentalis (page 178).

Figure 4.	Side view of the type of this species, slightly restored.

Hydatina parvula (page 180).

Figure 5.	Dorsal view of the type of this species.
Figure 5*a*.	The same specimen as seen from above, to show the sunken spire.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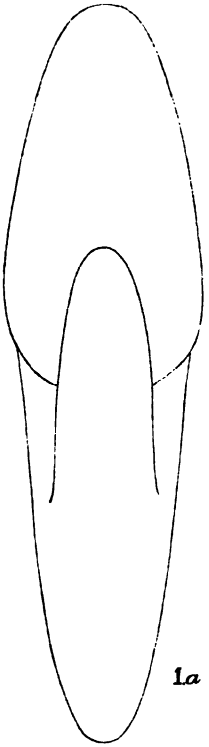
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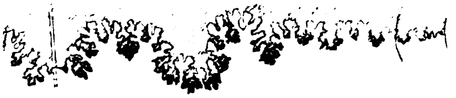
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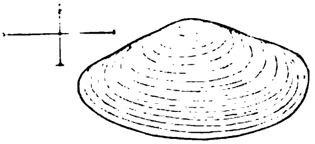
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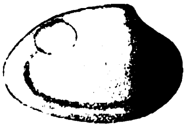
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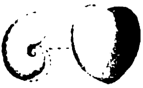
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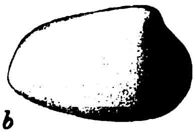
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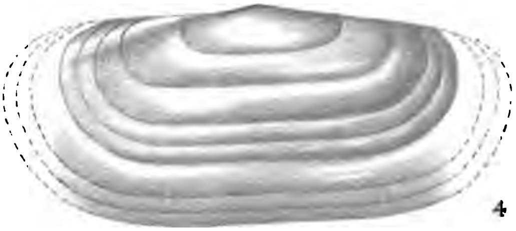
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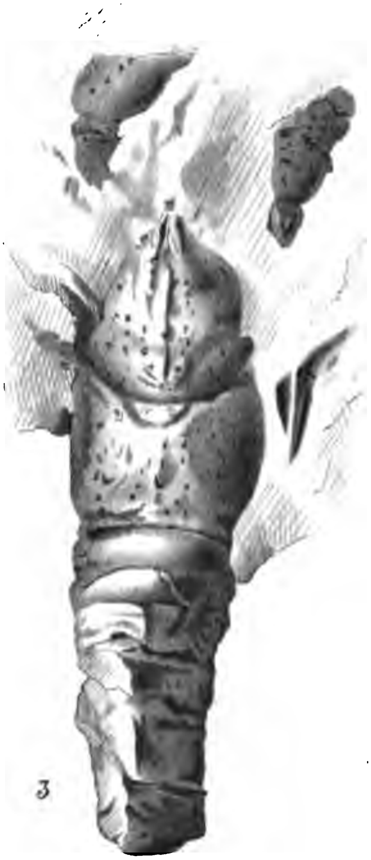
PLATE XXV.

Martesia tumidifrons (page 179).

Figure 1.	Side view of the type of this species, shewing the right valve.
Figure 1*a*.	The same specimen as seen from above, to shew the amount of convexity of the closed valves. In outline.
Figure 2.	Side view of another specimen of the same species, with a considerable portion of the test preserved.

Palæastacus (?) ornatus (page 183).

Figure 3.	View of the type and only specimen of this species known to the writer, as seen from above.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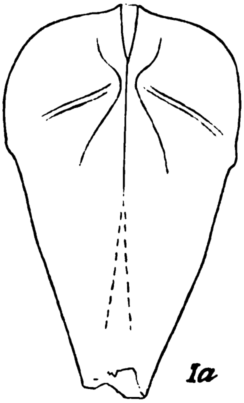
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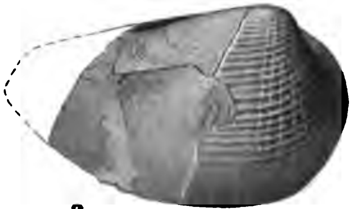
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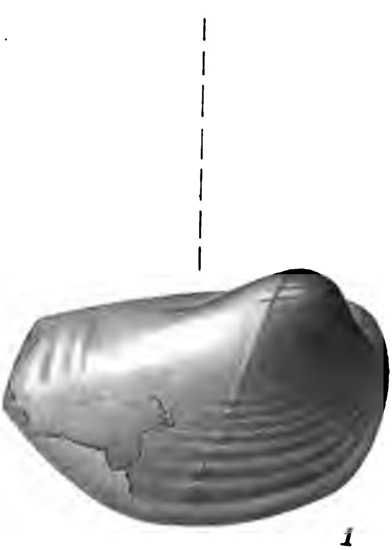
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PLATE XXVI.

Serpula semicoalita (page 185).

Figure 1.	The type of this species as seen from above.

Modiola tenuisculpta (page 188).

Figure 2.	Side view of the most perfect specimen known to the writer.
Figure 2*a*.	A portion of the test enlarged, to show the sculpture.

Belemnitella Manitobensis (page 189).

Figure 3.	View of the dorsal side of an unusually well preserved guard of this species, from the Ochre River.
Figure 3*a*.	View of the ventral side of the same specimen.
Figure 3*b*.	Outline of a natural transverse section of the same, at the larger end.

Loricula Canadensis (page 190).

Figure 4.	The type of this species, three times the natural size. C, the carina; L, L, the lateral plates; T, one of the terga; and S, the scuta. With the exception of the carina, the plates not shaded are those of the upper side of the specimen, and those shaded of the lower.
Figure 4*a*.	The same specimen, of natural size.

Ptychodus parvulus (page 191).

Figure 5.	Lateral view of the only specimen known to the writer, three times the natural size.
Figure 5*a*.	Similar view of the same specimen, but of the natural size.
Figure 5*b*.	The same tooth as seen from above and enlarged three times.

Lamna Manitobensis (page 192).

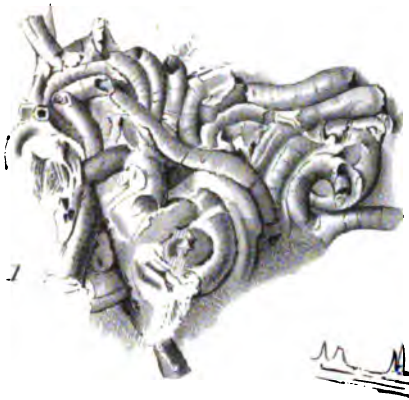
Figure 6.	View of the inner or convex side of the most perfect specimen of this species yet collected.
Figure 6*a*.	Profile view of the same tooth.
Figure 6*b*.	View of the outer or flattened side of the same.

Enchodus Shumardi (page 194).

Figure 7.	Outline of a dentary bone, with teeth, of a specimen from the Rolling River.
Figure 7*a*.	Another dentary bone belonging to the same specimen, showing the external sculpture of its surface.
Figure 7*b*.	One of the elongated fangs at the anterior extremity of the premaxillary of the same.
Figure 7*c*.	Maxillary bone of the same specimen.

Cladocyclus occidentalis (page 195).

Figure 8.	A comparatively narrow scale, which is somewhat pointed at both ends, of a fish which is here provisionally referred to this species.
Figure 9.	A similarly sculptured scale, but of more nearly circular form, of a fish which is also presumed to be referable to this species.



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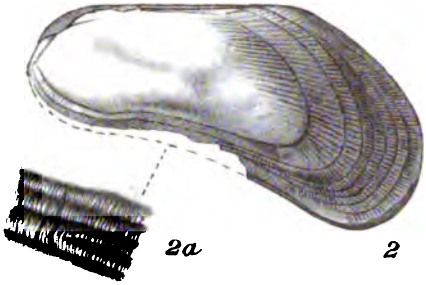

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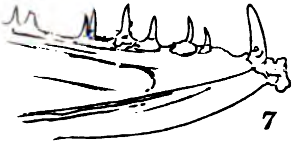

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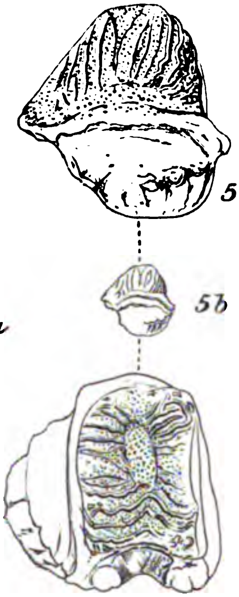

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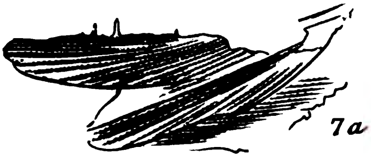

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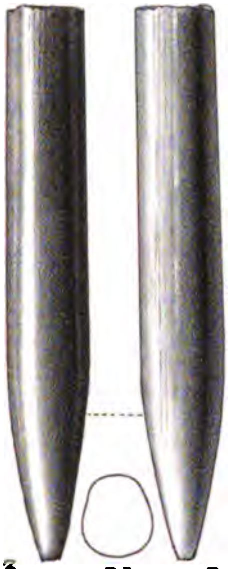

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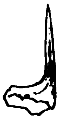

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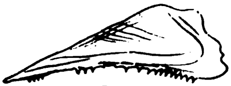

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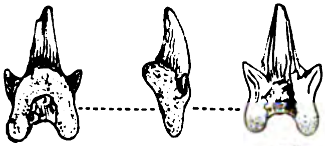

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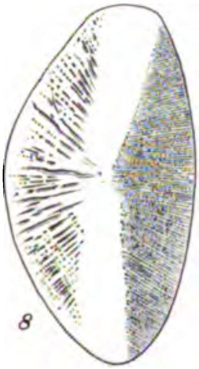

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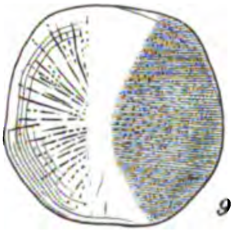

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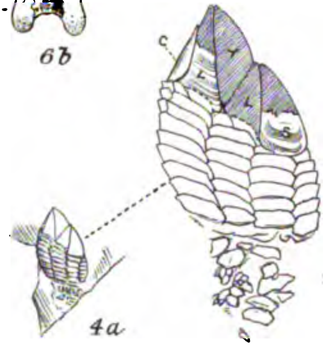

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PLATE XXVII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

Streptelasma rectum (page 199).

Figure 1. Side view of a specimen from the Mackenzie River.
Figure 1*a*. Outline of the anterior end of the same as seen from above.
Figure 2. Longitudinal section of another specimen from the same locality.

Cyathophyllum Richardsoni (page 200).

Figure 3. Side view of one of the specimens collected by Mr. McConnell.
Figure 4. Longitudinal section of another specimen.

Campophyllum ellipticum (page 202).

Figure 5. Side view of a specimen from the Hay River.
Figure 6. Longitudinal section of a large but imperfect specimen from the same locality.

Cyathophyllum cæspitosum (page 200).

Figure 7. Side view of a simple, or nearly simple, specimen from the Hay River. On the other side of this specimen, however, there is a single lateral bud.
Figure 8. Longitudinal section of another specimen from this locality.

Heliophyllum parvulum (page 203).

Figure 9. Side view of one of the types of this species, from the Hay River.
Figure 9*a*. Longitudinal section of the same.
Figure 10. Side view of another specimen from the Hay river.

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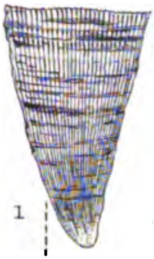
PLATE XXVII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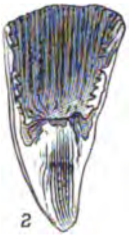
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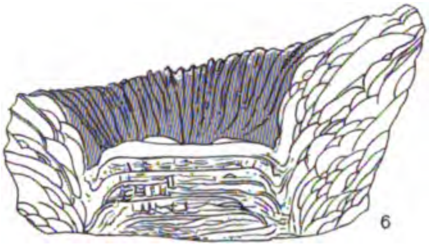
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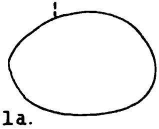
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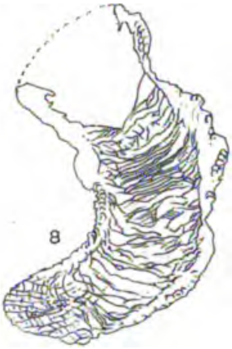
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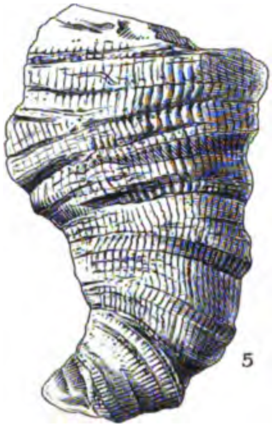
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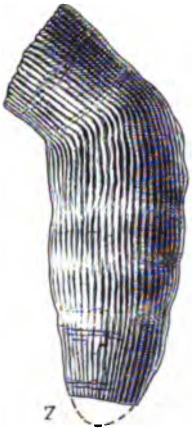
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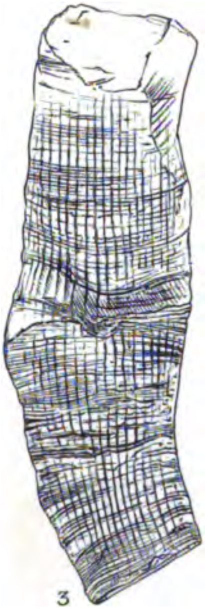
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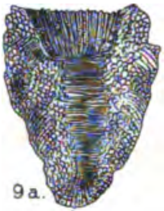
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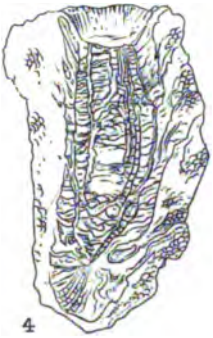
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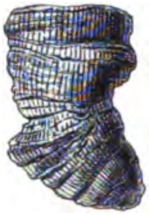
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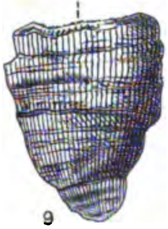
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Mortimer, Lith.

PLATE XXVIII.

Astræospongia Hamiltonensis (page 197).

Figure 1. A spicule from the Hay River, supposed to be referable to this species.

Figure 1*a*. The same, fourteen times the natural size.

Arachnocrinus Canadensis (page 208).

Figure 2. Lateral view of the dorsal cup of the only known specimen of this species. Twice the natural size.

Figure 2*a*. Diagram of the plates of the dorsal cup of the same. Four times the natural size.

Spirorbis omphalodes (page 209).

Figure 3. A small and probably immature specimen, as seen from above, with the outer volution rounded and somewhat depressed, and the umbilicus comparatively wide. Twelve times the natural size.

Figure 4. Similar view of a larger and probably adult example. The outer volution is elevated and subangulated, and the umbilicus rather narrow. Six times the natural size.

Figure 4*a*. Outline of the same, as viewed laterally.

Figure 5. Another specimen, in which the umbilical margin only is minutely plicated, as seen from above. Four times the natural size.

Figure 5*a*. Lateral outline of the same.

Cornulites (Ortonia) sublævis (page 210).

Figure 6. A calcareous tube of this species, as seen from above, with the outline of its aperture. Both three times the natural size.

Figure 7. Another tube of this species, also three times the natural size.

Hederella Canadensis (page 210).

Figure 8. A colony of this species, as seen from above.

Figure 8*a*. A portion of the same, three times the natural size.

Proboscina laxa (page 212).

Figure 9. The only specimen collected, as seen from above.

Figure 9*a*. A portion of the same, eight times the natural size.

Stomatopora moniliformis (page 212).

Figure 10. A colony of this species, as seen from above, and ten times the natural size.

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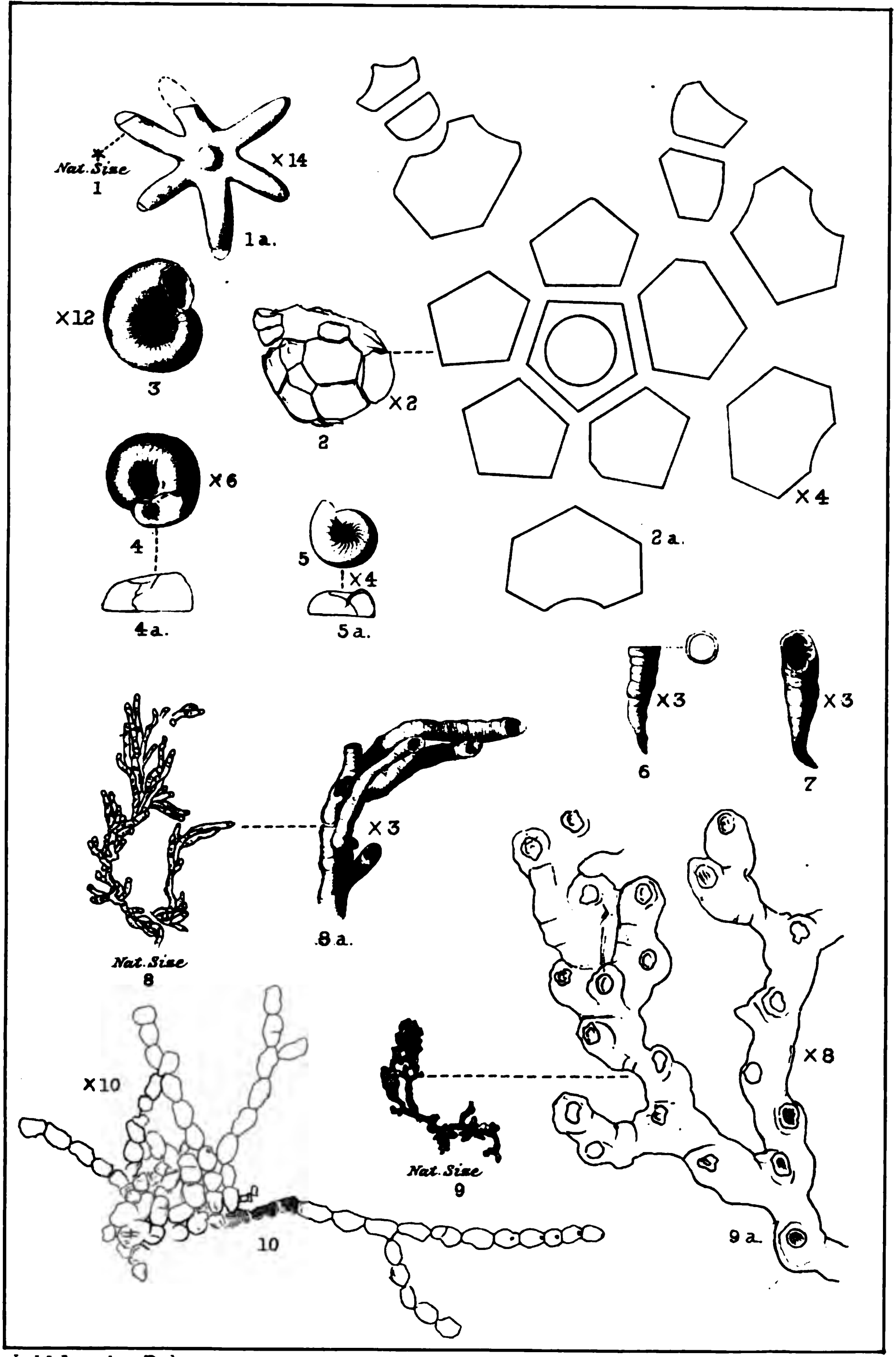

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PLATE XXIX.

AULOPORA FILIFORMIS, Billings, (page 211).

Figure 1. Side view of the only known specimen of this species, which has not previously been figured. Introduced for comparison.

CHONETES LOGANI, var. AURORA (page 215).

Figure 2. Ventral valve of a specimen from the Mackenzie River at the "Ramparts."

Figure 2*a*. Portion of the same, magnified four times, to shew the surface ornamentation.

PRODUCTELLA SPINULICOSTA (page 217).

Figure 3. Dorsal view of a specimen from the Hay River, which is somewhat doubtfully referred to this species. Twice the natural size.

Figure 3*a*. Profile view of the same, also twice the natural size.

SPIRIFERA DISJUNCTA (page 221).

Figure 4. Dorsal view of a perfect and typical specimen from the Hay River.

SPIRIFERA DISJUNCTA, var. OCCIDENTALIS (page 222).

Figure 5. Dorsal view of a specimen from the Hay River.

Figure 5*a*. Profile view of the same.

EATONIA VARIABILIS (page 233).

Figure 6. Dorsal view of a specimen with the front margin subtruncated, and four plications on the dorsal valve.

Figure 6*a*. Profile view of the same.

Figure 7. Dorsal view of a specimen in which as many as thirteen plications can be counted on the regularly rounded front margin.

Figure 8. Dorsal view of a specimen in which there are only two central and no lateral plications in the dorsal, and in which the front margin of both valves is produced into a short rounded lobe.

Figure 8*a*. Profile view of the same.

Figure 9. Portion of the umbonal region of another specimen, to show the perforate beak of the ventral valve.

STRINGOCEPHALUS BURTINI (page 235).

Figure 10. Outline of the dorsal aspect of a cast of the interior of both valves of this species, of normal form.

Figure 10*a*. Outline of the same, in profile.

Figure 11. Dorsal view of another cast of the interior of a shell of this species, of unusually globose form, and in which the beak of the ventral valve is strongly recurved over that of the dorsal.

Figure 11*a*. Profile view of the same.

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PLATE XXIX.

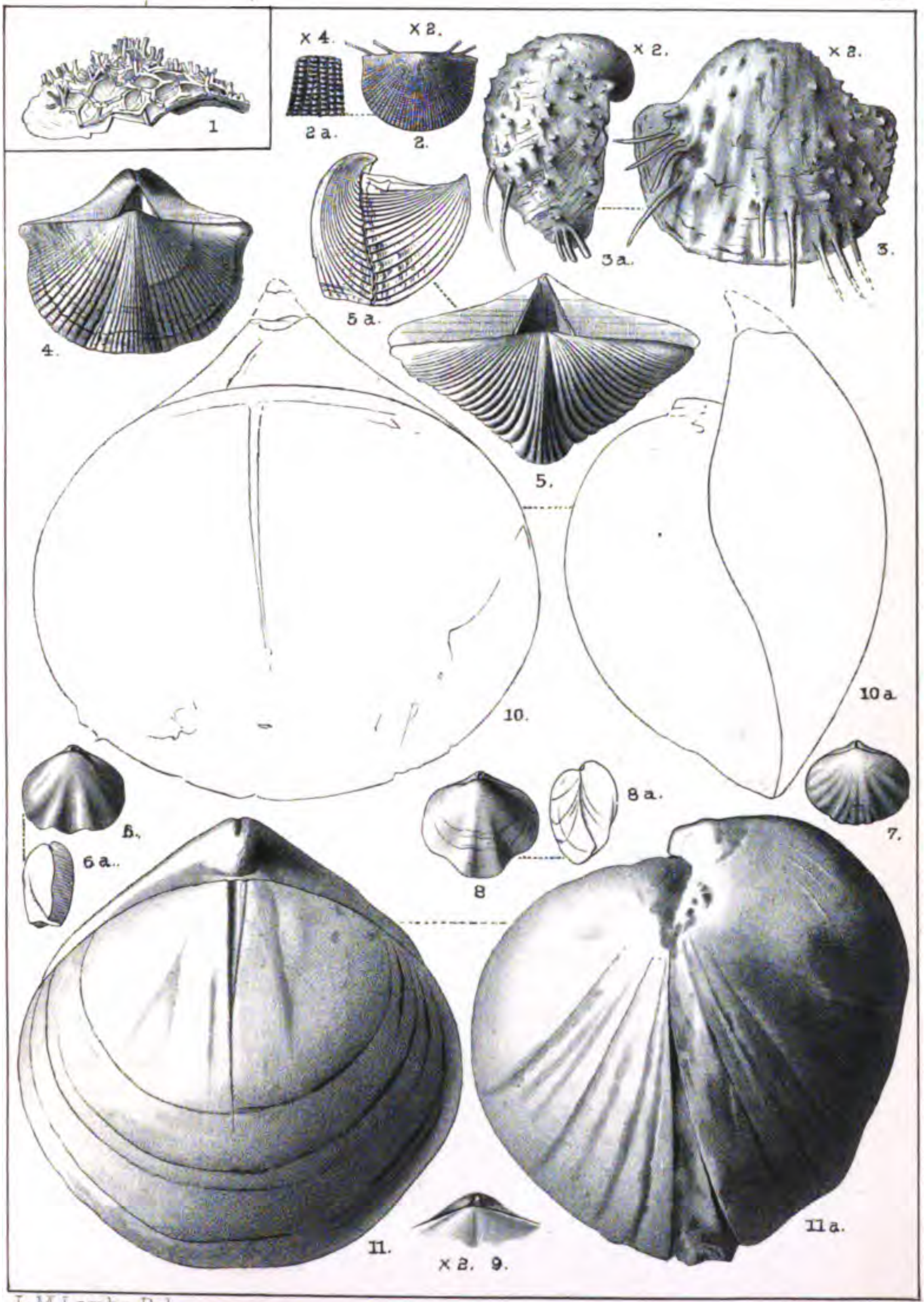

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PLATE XXX.

MONOTRYPELLA UNJIGA (page 214).

Figure 1.	Terminal branchlet, natural size,
Figure 1*a*.	Portion of the same, four times the natural size.
Figure 1*b*.	Transverse section of a terminal branchlet, x 30.
Figure 1*c*.	Longitudinal " " " " "
Figure 1*d*.	Tangential " " " " "

PENTAMERUS GALEATUS (page 234).

Figure 2.	Dorsal view of the specimen referred to in the text.

NEWBERRIA LÆVIS (page 237).

Figure 3.	Cast of the interior of the closed valves of a specimen of this species, shewing the characters of the dorsal valve.
Figure 4.	Dorsal view of a specimen with the test preserved.
Figure 4*a*.	Profile of the same, in outline.

SCHIZODUS CHEMUNGENSIS (page 241).

Figure 5.	Side view of the specimen referred to in the text.
Figure 5*a*.	Outline of the same, as seen from above.

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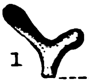

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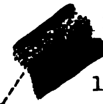

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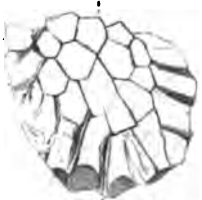

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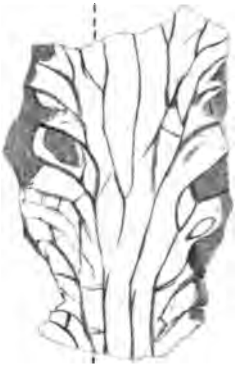
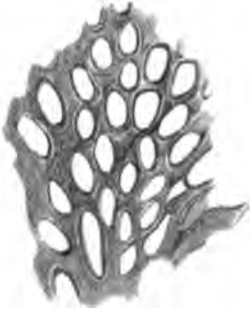
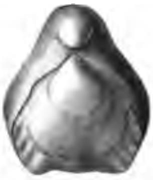


1c. × 30



1d. × 30



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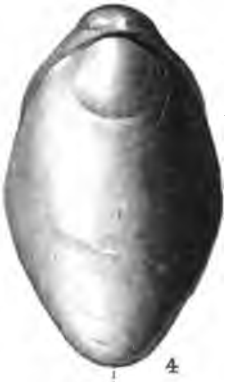

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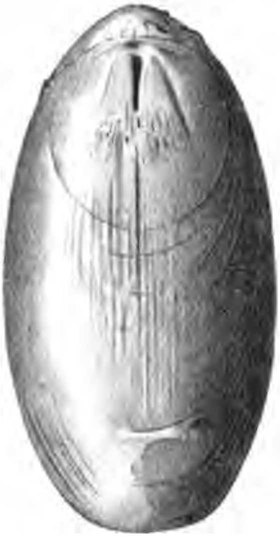

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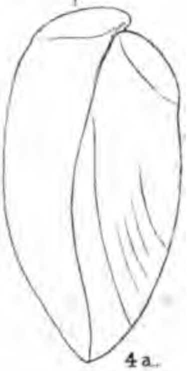

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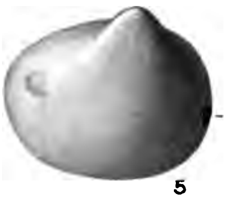

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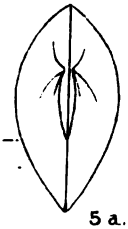

5 a.

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PLATE XXXI.

PRODUCTELLA SPINULICOSTA (page 217).

Figure 1. Outline of ventral valve of the specimen from the Mackenzie River at " Grand View," referred to in the text.

EUOMPHALUS (STRAPAROLLUS) FLEXISTRIATUS (page 242).

Figure 2. The type of this species, as seen from above.
Figure 2*a*. The same, as seen from below.

EUOMPHALUS (STRAPAROLLUS) INOPS (page 242).

Figure 3. Upper side of a specimen of this species from the Mackenzie River at the "Ramparts."
Figure 3*a*. Lower side of the same.

EUOMPHALUS MASKUSI (page 243).

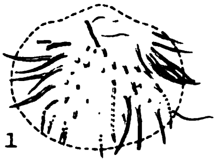
Figure 4. View of the upper side of the most perfect specimen collected, drawn from a gutta percha impression taken from a natural mould of the exterior of the shell.

GONIATITES (page 245).

Figure 5. Side view of the specimen from the Hay River referred to in the text.

PROETUS HALDEMANI (page 246).

Figure 6. Outline of a head of this species, from the Mackenzie River at " Grand View," as seen from above.
Figure 7. Outline of united thorax and pygidium of a specimen from the same locality.
Figure 8. Outline of another head of this species, also from "Grand View."



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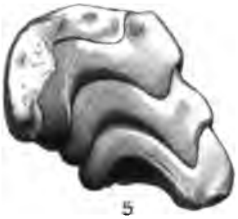

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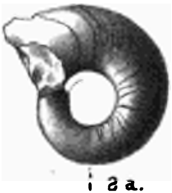

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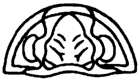

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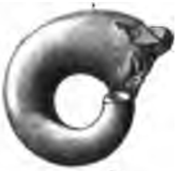

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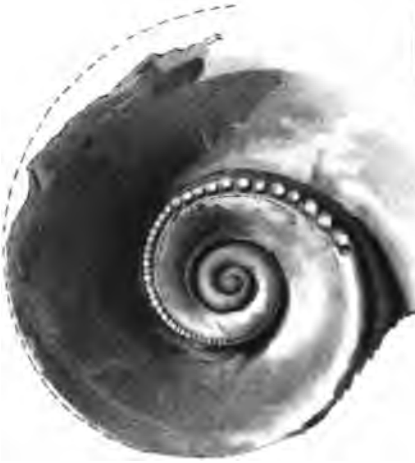

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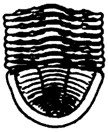

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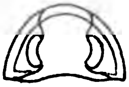

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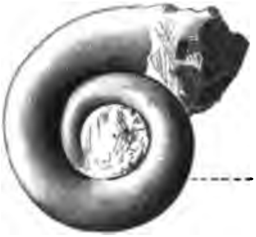

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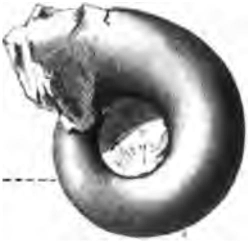

3 a.

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Mortimer, Lith.

PLATE XXXII.

Cyathophyllum Athabascense (page 202).

Figure 1.	Side view of the largest and most perfect specimen collected.
Figure 1*a*.	Longitudinal section through the centre of the same.
Figure 1*b*.	Transverse section of the same, below the base of the cup.

Spirifera tullia (page 224).

Figure 2.	Dorsal view of a specimen from the Athabasca River.
Figure 2*a*.	Ventral view of the same specimen.
Figure 2*b*.	Portion of the same, five times the natural size, to shew the surface ornamentation of the ribbed lateral areas.

Athyris Angelica, var. occidentalis (page 227).

Figure 3.	Dorsal view of a specimen from the Athabasca River.
Figure 3*a*.	Ventral view of the same.
Figure 3*b*.	Front view of the same.

Athyris parvula (page 228).

Figure 4.	Dorsal view of a specimen from the Athabasca River, three miles below the Calumet, and referred to in the text as No. 1.
Figure 5.	Similar view of a specimen from the Athabasca River, thirty miles below Red River, and referred to in the text as No. 2.
Figure 5*a*.	Front view of original of fig. 5.

Ptychopteria æquivalvis (page 239).

Figure 6.	Side view of the type specimen.
Figure 6*a*.	Cardinal view of the same, to shew the equal convexity of the two valves.

Leptodesma Demus (page 240).

Figure 7.	A left valve of this species, from the Athabasca River.

Leptodesma Jason (page 240).

Figure 8.	Lateral view of a specimen of this species, from the Athabasca River, showing only the left valve, though both are preserved.

Conularia Salinensis (page 244).

Figure 9.	Side view of the only specimen collected.
Figure 9*a*.	A portion of the same, five times the natural size.

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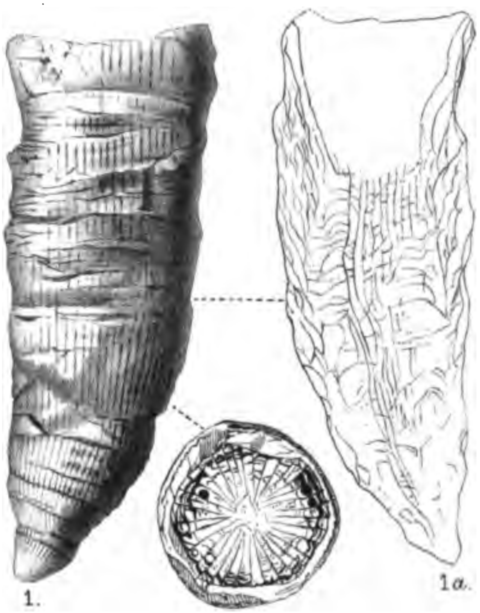
PLATE XXXII



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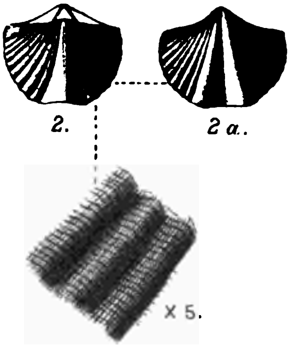

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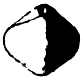

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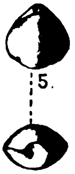

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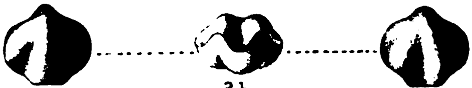

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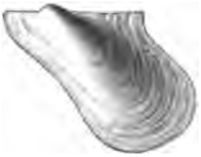

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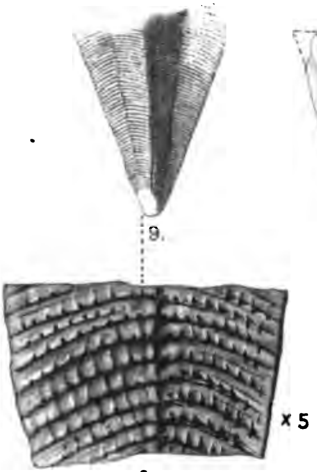

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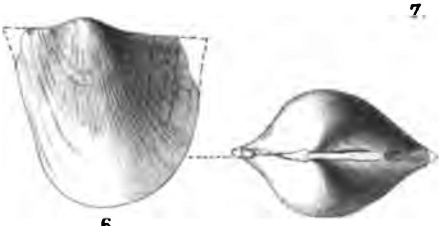

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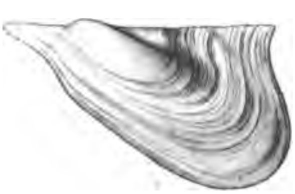

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Mortimer, Lith.

PLATE XXXIII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

SPHÆROSPONGIA TESSELLATA (page 259).

Figure 1. Side view of a specimen in which none of the spicular head plates are preserved, but which is otherwise nearly perfect, shewing the general arrangement of the spicules, minus the head plates, and the meeting at the apex of the prolonged distal rays of the summit spicules. Twice the natural size.

Figure 1*a*. Portion of the same, enlarged three times, to shew the mode of interlocking of the spicules.

Figure 2. Some of the spicular head plates of another specimen, enlarged four times.

Figure 3. Restoration of the species as it occurs in this region, the details supplied from a number of specimens, which, however, do not shew whether there was or was not an opening at the apex, or whether there were or were not any head plates to the apical spicules.

Figure 4. Side view of a nearly cylindrical specimen.

Figure 5. Specimen with the basal plates preserved. Three times natural size.

Figure 5*a*. Diagram shewing the shape and arrangement of the basal plates.

Figure 6. Outline of an arcuate and club-shaped specimen.

Figure 7. Outline of part of a slender specimen which is curved in two directions.

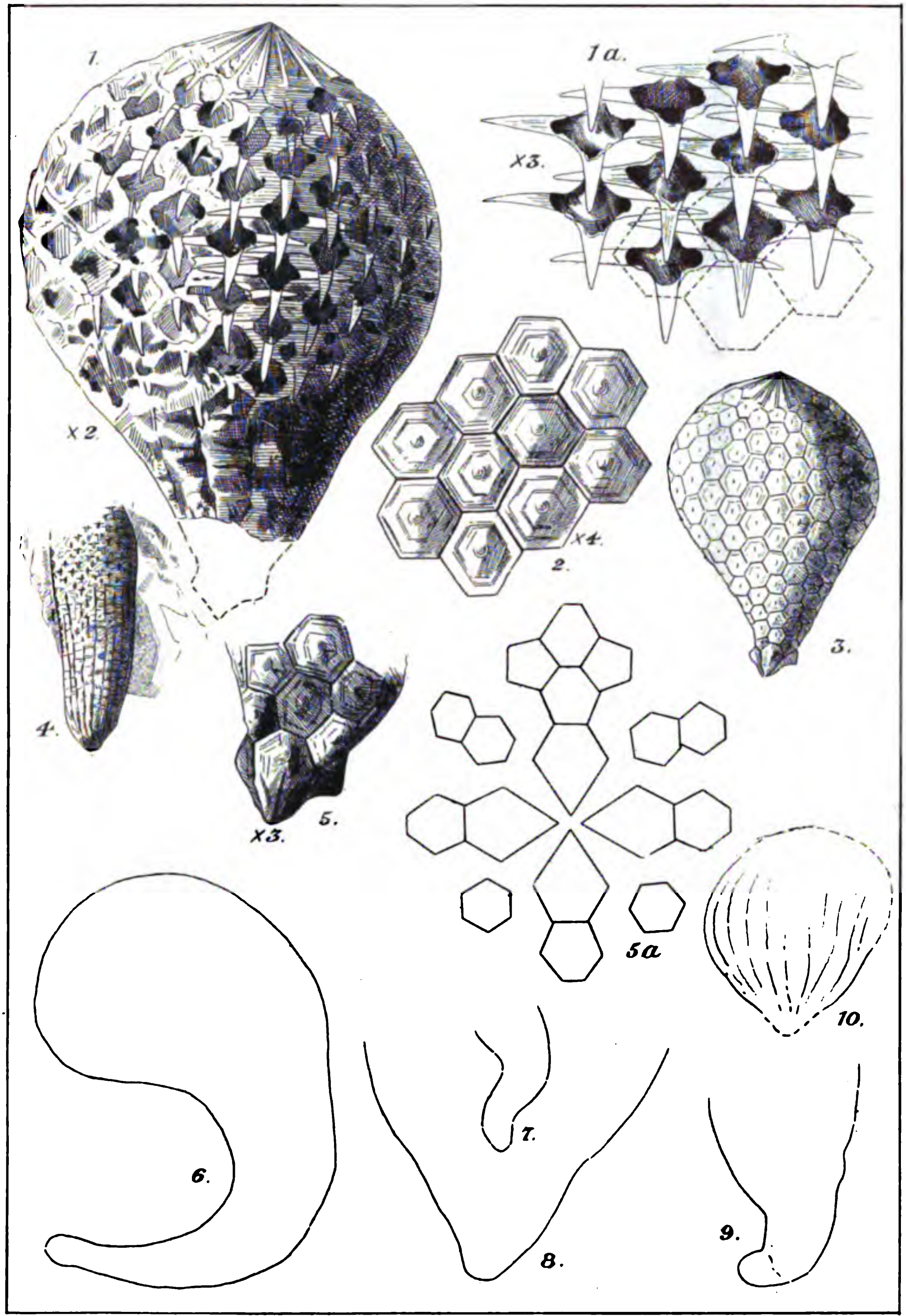
Figure 8. Outline of basal portion of a broadly conical specimen.

Figure 9. Outline of an imperfect subconical specimen.

Figure 10. Outline of a subpyriform specimen.

The originals of all the figures on this plate, are from the shores or islands of Dawson Bay, Lake Winnipegosis.

PLATE XXXIII.



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Mortimer, Lith.

PLATE XXXIV.

CYATHOPHYLLUM PETRAIOIDES (page 265).

Figure 1. Side view of a specimen from the Red Deer River, at the Lower Salt Spring.

Figure 1*a*. Longitudinal section of the same, to shew the internal structure.

Figure 2. The other half of the same specimen, shewing the base of attachment.

COLUMNARIA (CYATHOPHYLLOIDES) DISJUNCTA (page 269).

Figure 3. Natural longitudinal section of a portion of a large colony of this species, from the western shore of Dawson Bay, at the mouth of the Steep Rock River.

Figure 3*a*. One of the corallites of the same, twice the natural size, to shew the structure of the interior more clearly.

Figure 3*b*. Transverse section of another portion of the same colony, to shew the outlines of the corallites, their relative arrangement and the number and proportionate length of the septa.

CYATHOPHYLLUM PROFUNDUM, Var. (page 268).

Figure 4. Longitudinal section of one of the corallites of a large colony from Snake Island, Lake Winnipegosis, to shew its internal structure and the shape of the calyx.

Figure 4*a*. Transverse section of four adjacent corallites of the same, shewing the thin walls, and the number and length of the septa.

CYATHOPHYLLUM WASKASENSE (page 264).

Figure 5. Side view of a simple specimen from the Red Deer River.

Figure 5*a*. Longitudinal section of the same, to show the internal structure.

Figure 6. A proliferous specimen, from the same locality, shewing lateral gemmation.

Figure 7. A proliferous specimen, also from the Red Deer River, showing calycinal gemmation.

CYATHOPHYLLUM ATHABASCENSE, Var. (page 269).

Figure 8. Side view of the specimen from Cameron Bay, Lake Winnipegosis.

Figure 8*a*. Longitudinal section of the same.

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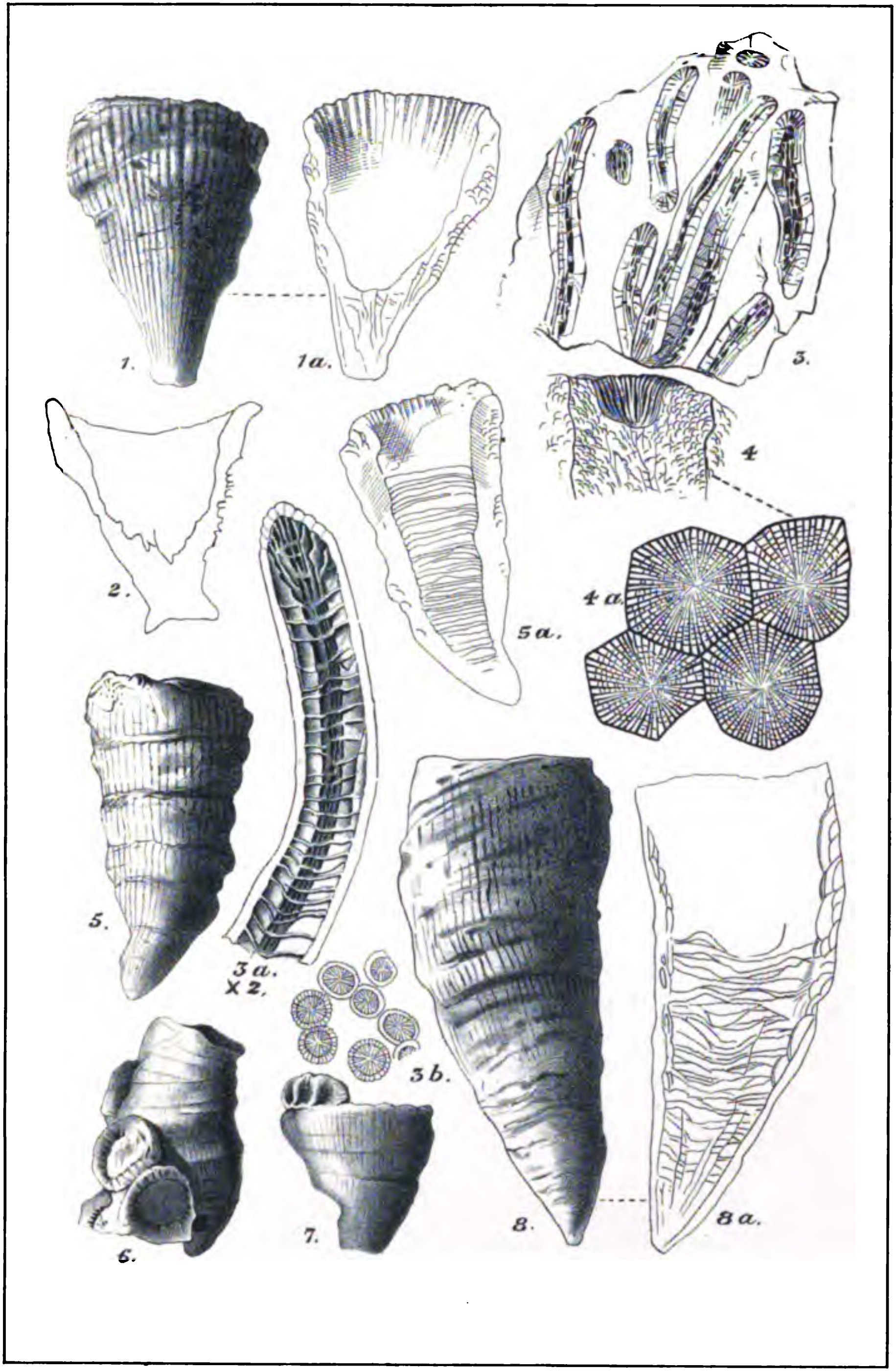

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Mortimer, Lith.

PLATE XXXV.

CYATHOPHYLLUM VERMICULARE, var. PRÆCURSOR (page 263).

Figure 1. Side view of an unusually broad and short specimen, from a small island at the south end of Lake Winnipegosis.

Figure 1*a*. Longitudinal section of the same.

Figure 1*b*. Transverse section of the same, at a short distance below the base of the calyx.

AMPLEXUS, or DIPHYPHYLLUM. Sp. (page 270).

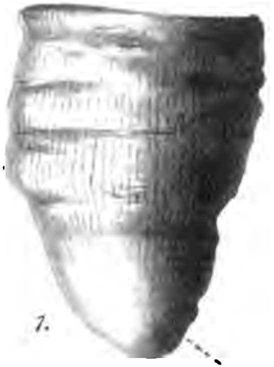
Figure 2. Natural longitudinal section of one of the corallites of a specimen from the western shore of Dawson Bay, at the first small point north of the Red Deer River.

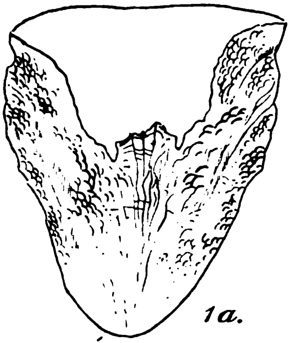
Figure 2*a*. Transverse section of a similar specimen from the same locality.

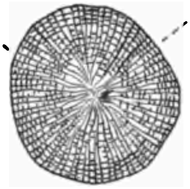
ACTINOCYSTIS VARIABILIS (page 271).

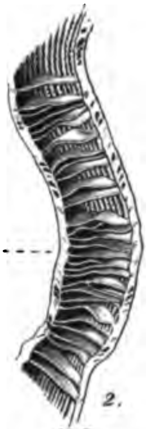
Figure 3. Longitudinal section of an imperfect specimen of this species, from the south end of Rowan Island, Dawson Bay, Lake Winnipegosis.

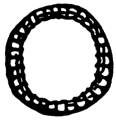
Figure 3*a*. Transverse section of the same, a little below the base of the calyx.

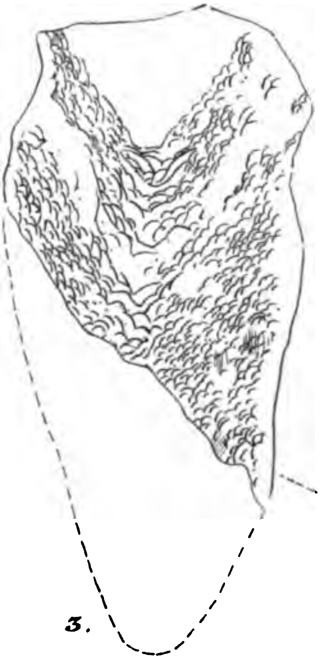












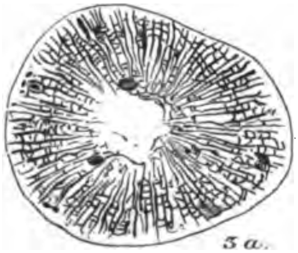


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PLATE XXXVI.

PINACOTRYPA MARGINATA (page 278).

Figure 1. A perfect zoarium of this species, from a small island in Dawson Bay, as viewed from above, and shewing five maculæ.

Figure 1*a*. Portion of the same, three times the natural size, shewing one of the maculæ, &c.

Figure 1*b*. Another specimen from the same locality, four times the natural size, shewing the at first recumbent but ultimately erect zoœcia, the broad and longitudinally striated basal lamina, &c.

CYSTODICTYA HAMILTONENSIS (page 279).

Figure 2. Outline of a portion of the zoarium of this species, from a small island in Dawson Bay.

Figure 2*a*. The same specimen, enlarged three times, and shewing the details of its structure.

Figure 2*b*. Portion of the same, enlarged eight times.

FINESTELLA VERA (page 279).

Figure 3. Side view of the outer or non-celluliferous surface of the zoarium of a specimen of this species, from a small island in Dawson Bay.

Figure 3*a*. Portion of the same, enlarged five times, with the right side partly scraped down to show the zoœcia.

FENESTELLA, like F. DISPANDA (page 279).

Figure 4. Outline of a specimen of this species, from the south-eastern shore of Dawson Bay, at Whiteaves Point.

POLYPORA (POROSA ? var.) MANITOBENSIS (page 280).

Figure 5. Portion of a zoarium of this species, from Monroe Point, Lake Manitoba, four times the natural size, shewing the non-celluliferous side, but with the lower part scraped down to show the zoœcia.

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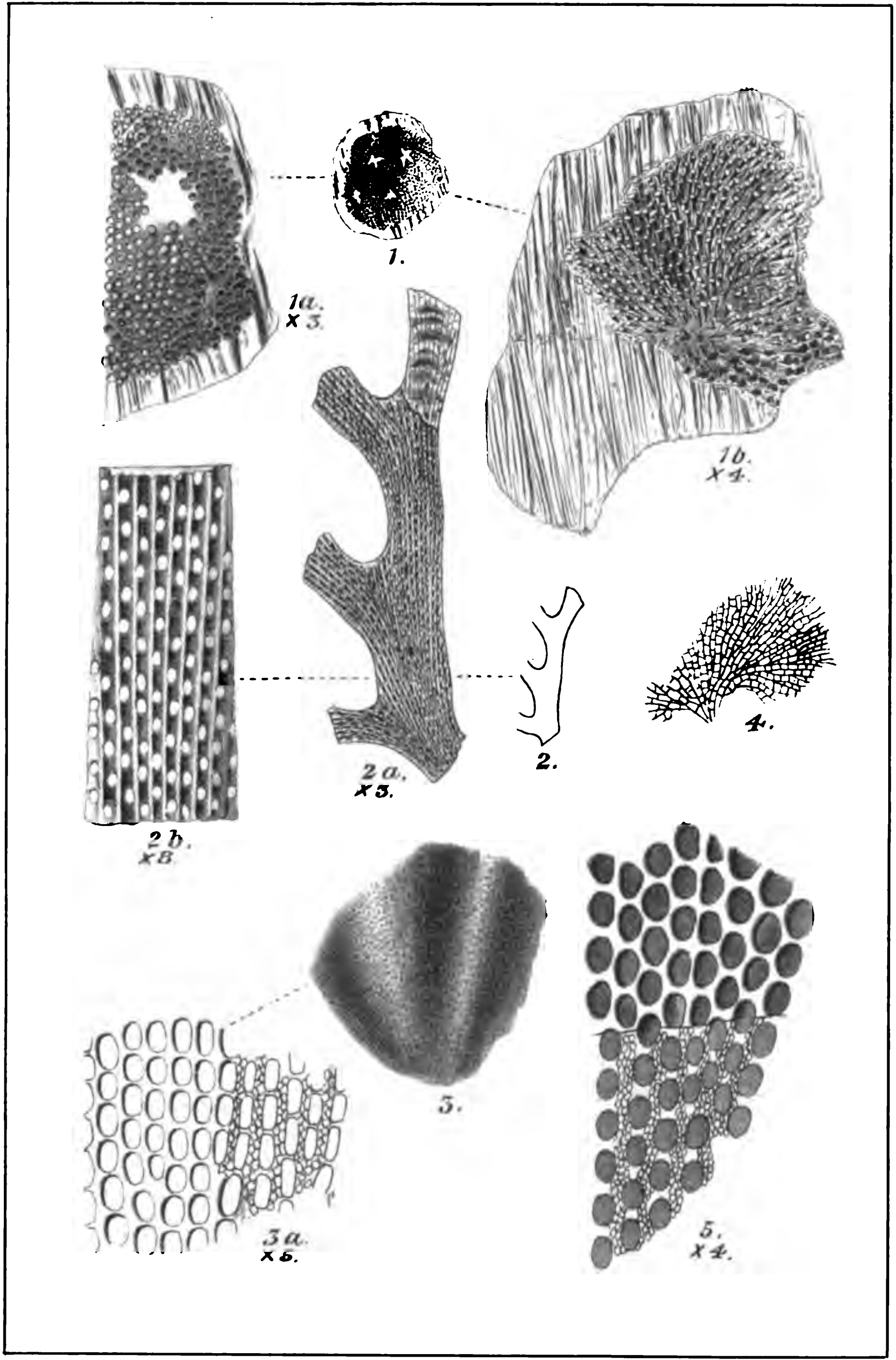
PLATE XXXVI.



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Mortimer, Lith

PLATE XXXVII.

Chonetes Manitobensis (page 281).

Figure 1. Specimen from the north side of Manitoba Island shewing the exterior of the ventral valve and the spines on its cardinal border. Twice the natural size.

Figure 1*a*. Portion of the same enlarged four times, to shew the surface markings more clearly.

Figure 2. Another specimen from Manitoba Island, shewing the whole of the dorsal valve, and the hinge area, but not the cardinal spines, of the ventral valve. Twice the natural size.

Orthis (Schizophoria) Manitobensis (page 283).

Figure 3. Specimen from a small island in Dawson Bay, shewing the exterior of the "dorsal" or most convex and brachial valve only.*

Figure 3*a*. Portion of the same, twice the natural size.

Figure 4. Specimen from the same locality, shewing the front margin and relative convexity of both valves.

Figure 5. Cast of the interior of the "dorsal" or brachial valve of a shell which is probably referable to this species, from Devils Point, Lake Winnipegosis.

Figure 5*a*. Umbonal region of the same, enlarged three times, to shew the impressions made by the very short median septum in the beak and by the two divergent brachial processes.

Strophodonta interstrialis (page 286).

Figure 6. Specimen from a small island on the east side of Dawson Bay, shewing the exterior of the ventral valve.

Spirifera (Martinia) Richardsonii (page 287).

Figure 7. Specimen from the south-west shore of Dawson Bay, which is probably referable to this species, shewing the interior of the shell, the spiral coils and hinge dentition.

Atrypa reticularis (page 289).

Figure 8. Specimen from Pentamerus Point, Lake Manitoba, in which most of the broad marginal fringe or foliated expansion of the ventral valve is preserved.

Terebratula Sullivanti (page 291).

Figure 9. Dorsal view of a specimen from Whiteaves Point, Dawson Bay, with a short mesial sinus in each valve, and the anterior border emarginated.

Figure 9*a*. Ventral view of the same.

Figure 10. Dorsal view of another specimen from a small island in Dawson Bay, north of Salt Point, in which there is no sinus in either valve, nor any emargination of the anterior border.

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*Œhlert, in Fischer's Manuel de Conchyliologie, p. 1287, calls the corresponding valve of *Orthis* (*Schizophoria*) *striatula*, the "ventral."

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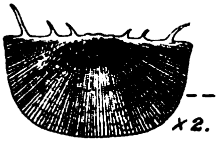

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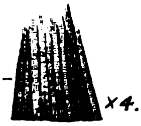

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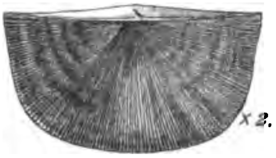

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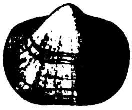

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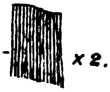

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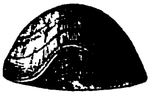

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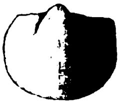

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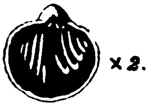

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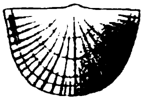

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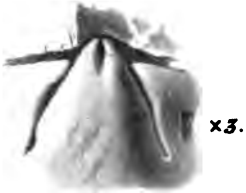

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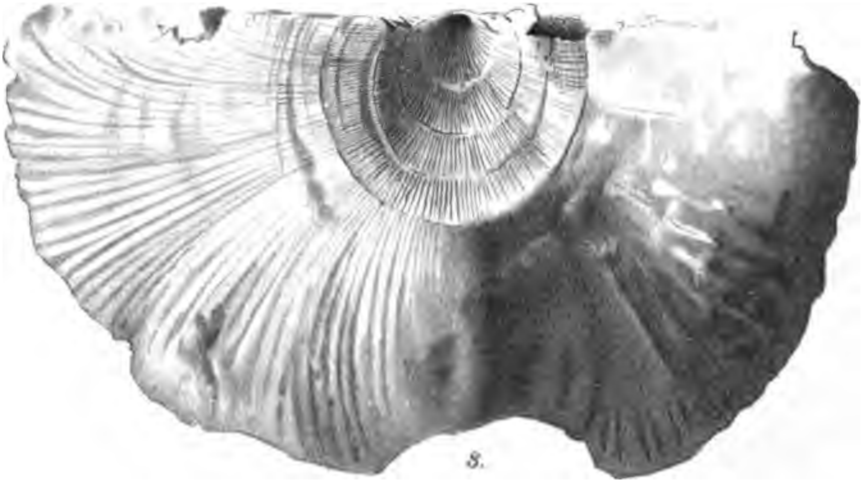

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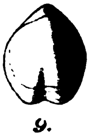

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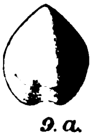

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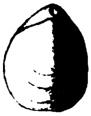

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Mortimer, Lith.

PLATE XXXVIII.

Pterina lobata (page 292).

Figure 1. Side view of the largest specimen collected, from a small island in Dawson Bay, shewing the whole of the right valve and part of the left.

Figure 2. Side view of an imperfect left valve, from Dawson Bay, at Whiteaves Point.

Figure 3. Side view of an immature specimen of the left valve, from the western shore of Dawson Bay, at the mouth of Steep Rock River.

Figure 4. Imperfect left valve of a very young shell, from Whiteaves Point, which may be referable to this species.

Mytilarca inflata (page 293).

Figure 5. Side view of the largest specimen collected, from the western shore of Dawson Bay, at the mouth of Steep Rock River, shewing the right valve.

Figure 6. Side view of a small specimen, from a small island north of Whiteaves Point, in Dawson Bay, showing the left valve.

Figure 6*a*. Ventral aspect of the same.

Myalina trigonalis (page 294).

Figure 7. Side view of the only specimen collected, from Dawson Bay, at the first small point north of the mouth of the Red Deer River.

Figure 7*a*. Ventral view of the same.

Figure 7*b*. Dorsal view of the same.

Modiomorpha compressa (page 296).

Figure 8. Side view of a cast of the interior of both valves, from the south-eastern shore of Dawson Bay, at Whiteaves Point, shewing the general shape of the left valve, the anterior muscular impression, and a very small portion of the test posteriorly.

Figure 9. Side view of a similar cast of another specimen, from the western shore of Dawson Bay, at the mouth of Steep Rock River.

Modiomorpha tumida (page 296).

Figure 10. Side view of the largest specimen collected, which is a cast of the interior of the slightly separated valves, shewing the general shape of the right valve, from the south-west side of Lake Winnipegosis, at a small island off Weston Point.

Figure 10*a*. Outline of the same, as seen from above.

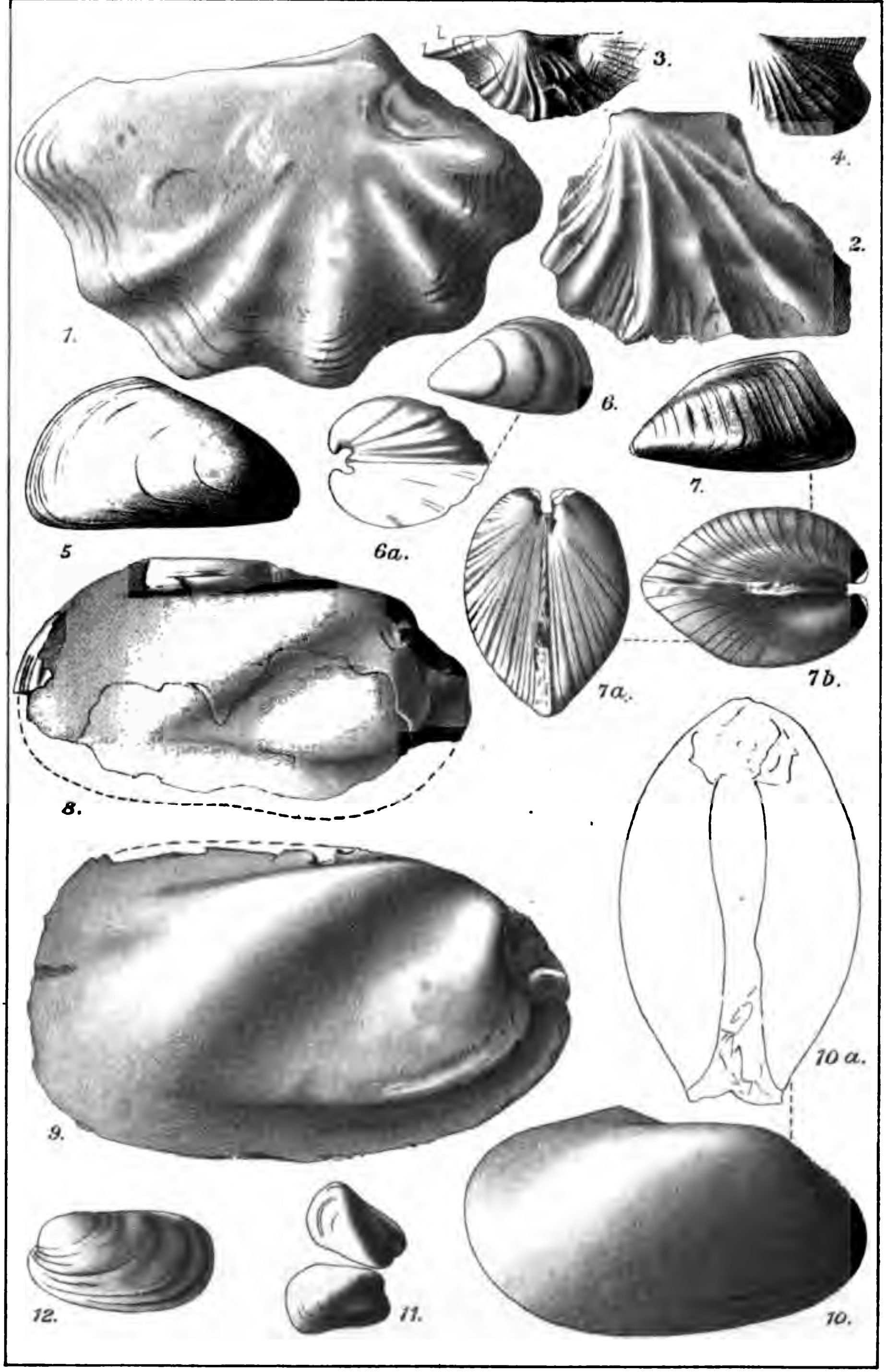
Modiomorpha parvula (page 297).

Figure 11. Cast of the interior of the widely spread out valves of a specimen from the western shore of Dawson Bay, at the first small point north of the mouth of the Red Deer River.

Spathella subelliptica (page 298).

Figure 12. Side view of a cast of the interior of both valves, from the western shore of Dawson Bay, at the second small point north of the mouth of the Red Deer River, shewing the general form of the left valve, and indications of its surface workings.

PLATE XXXVIII



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Mortimer, Lith.

PLATE XXXIX.

GONIOPHORA PERANGULATA (page 299).

Figure 1. Side view of the most perfect specimen collected, a nearly perfect cast of the interior of both valves, from a small island off Whiteaves Point, Dawson Bay, shewing the right valve.

Figure 1*a*. Front view of a specimen from the western shore of Dawson Bay, near the mouth of Steep Rock River, in outline, to shew the amount of convexity of the two valves.

MACRODON PYGMÆUS (page 299).

Figure 2. Cast of the interior of a left valve, from the western shore of Dawson Bay, at the mouth of Steep Rock River.

Figure 3. Cast of the interior of the right valve of a specimen from Devils Point, Lake Winnipegosis.

NUCULITES. Sp. (page 302).

Figure 4. The "imperfect cast of the interior of a single valve" from the north side of Manitoba Island, referred to in the text, twice the natural size.

PARACYCLAS. Sp. Undt. (page 306).

Figure 5. Side view of the wax impression of a natural mould of the exterior of the closed valves from the first small point north of the mouth of the Red Deer River, in Dawson Bay, referred to in the text, shewing the right valve.

Figure 5*a*. Dorsal view of the same, in outline, to shew the proportionate convexity of the two valves.

PARACYCLAS ANTIQUA (page 304).

Figure 6. Side view of a wax impression of a natural mould of the exterior of the shell from the south-west shore of Dawson Bay, near the mouth of Steep Rock River, shewing the right valve.

PARACYCLAS ELLIPTICA, var. OCCIDENTALIS (page 305).

Figure 7. Specimen, which is believed to be quite free from distortion or compression, from the southern shore of Dawson Bay, at a small point about a mile east of Bell River.

Figure 8. Original drawing of the type of *Lucina occidentalis*, Billings, from Snake Island, Lake Winnipegosis.

Figure 9. Side view of a specimen from the Red Deer River, which has been obliquely distorted.

Figure 10. Side view of another specimen from the Red Deer River, in which the abnormal compression, in the direction of the height, has reached its maximum.

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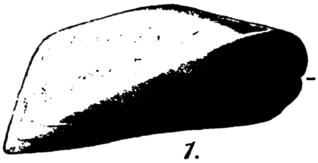
PLATE XXXIX.



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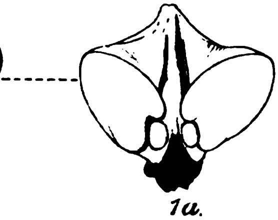

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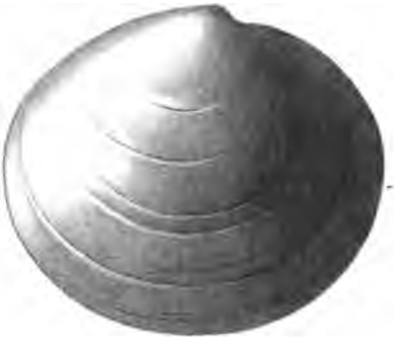

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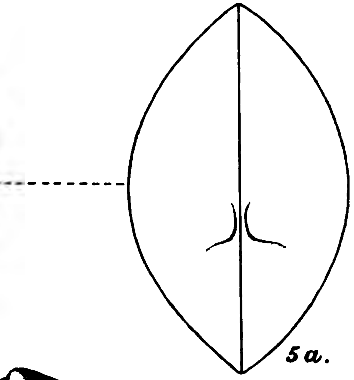

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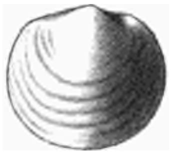

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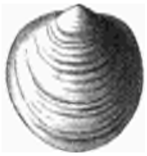

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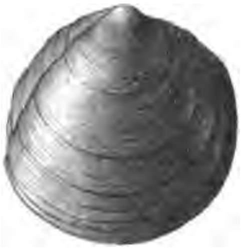

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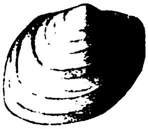

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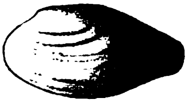

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PLATE XL

CARDIOPSIS TENUICOSTATA (page 307).

Figure 1. Side view of a large but imperfect left valve of this species, from Dawson Bay, two miles west of Salt Point.

Figure 2. Similar view of a smaller left valve from Dawson Bay, at the mouth of the Red Deer River.

CYPRICARDINIA PLANULATA ? Var. (page 309).

Figure 3. Gutta percha impression from a natural mould of the exterior of a left valve collected at Devils Point, Lake Winnipegosis.

CYPRICARDELLA BELLISTRIATA (page 308).

Figure 4. A comparatively large but imperfect cast of the interior of the closed valves of a specimen from Point Wilkins, Dawson Bay: lateral view, shewing the right valve.

Figure 5. Side view of a smaller and more perfect but in other respects similar specimen from the same locality, shewing the contour of the left valve.

ANODONTOPSIS AFFINIS (page 303).

Figure 6. Side view of a cast of the interior of a left valve, from Devils Point, Lake Winnipegosis.

GLOSSITES MANITOBENSIS (page 310).

Figure 7. Side view of the only specimen collected, from Pentamerus Point, Lake Manitoba, shewing the left valve.

CYPRICARDELLA PRODUCTA (page 309).

Figure 8. The wax impression of a natural mould of the exterior of a left valve from Dawson Bay, at the mouth of Steep Rock River, referred to in the text. Side view.

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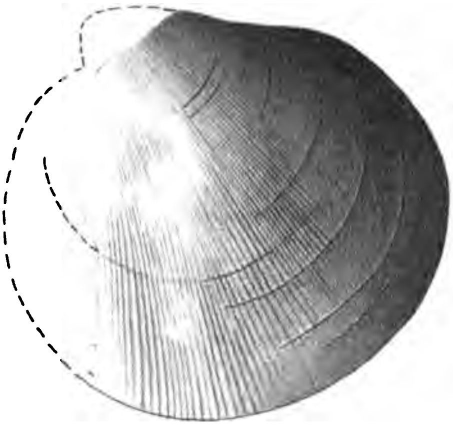
PLATE XL.



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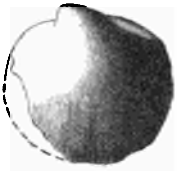

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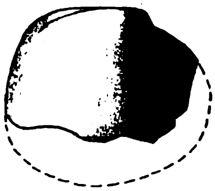

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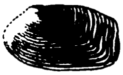

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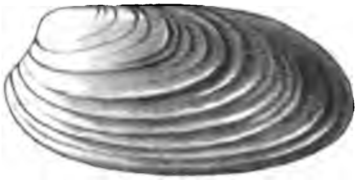

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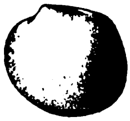

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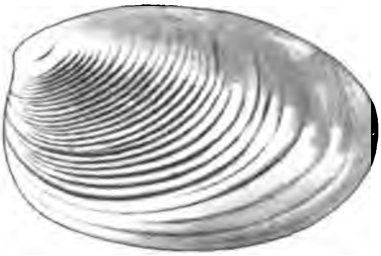

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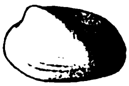

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Mortimer, Lith.

PLATE XLI.

Nucula (?) Manitobensis (page 301).

Figure 1. Side view of the larger of the two right valves collected, from a small island off Whiteaves Point, in Dawson Bay twice the natural size.

Pleurotomaria infranodosa (page 313).

Figure 2. Dorsal view of a small specimen with a considerable portion of the test preserved, from Pentamerus Point, Lake Manitoba.

Figure 2*a*. Basal view of the same.

Figure 3. Dorsal view of a cast of the interior of the shell of a large specimen of this species, from Dawson Bay, Lake Winnipegosis, about two miles west of Salt Point.

Pleurotomaria Spenceri (page 341).

Figure 4. The type specimen, from the western shore of Dawson Bay, as seen from above.

Figure 4*a*. Dorsal view of the same.

Figure 4*b*. Basal view of the same.

Raphistoma Tyrrellii (page 314).

Figure 5. Small specimen, with the whole of the test preserved, from Dawson Bay, about two miles west of Salt Point, as seen from above.

Figure 5*a*. Dorsal view of the same.

Figure 6. A cast of the interior of the shell of a large specimen from Dawson Bay, at a small point half a mile north of the mouth of Steep Rock River, as seen above.

Figure 6. Basal view of the same.

Figure 6*b*. Dorsal view of the same, in outline only.

Murchisonia turbinata, Var.* (page 358).

Figure 7. View of a gutta percha impression of a natural mould of the exterior of a shell of this species, in dolomite, from Dawson Bay, north of Steep Rock River.

Murchisonia Dowlingii (page 316).

Figure 8. View of a gutta percha impression of a sharply defined natural mould of the exterior of a shell of this species from Dawson Bay, four miles west of Salt Point.

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*Referred to in the text (page 315) as "*Murchisonia Archiacana*, Nov. Nom." but this name is preoccupied.

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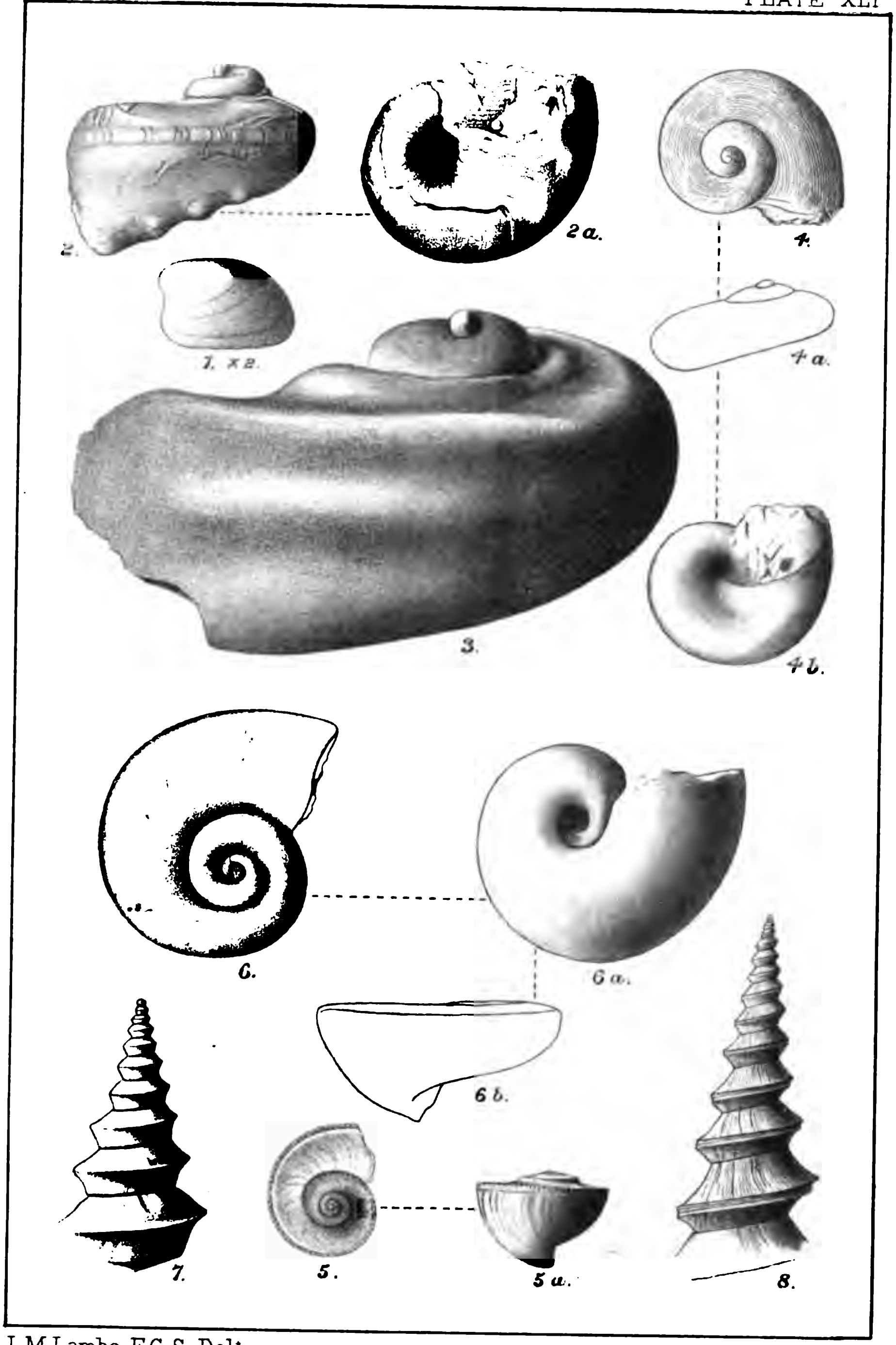
PLATE XLI



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Mortimer, Lith.

PLATE XLII.

PLEUROTOMARIA. Sp. Undt. (page 313).

Figure 1. Dorsal view of the specimen from Pentamerus Point, Lake Manitoba, referred to in the text.

BELLEROPHON PELOPS, var. (page 317).

Figure 2. Side view of an immature specimen, from the Red Deer River, a mile and a half above the Lower Salt Spring.

Figure 2*a*. Dorsal view of the same.

Figure 3. Outline of transverse section of a specimen from the first small point east of the mouth of Bell River, in Dawson Bay, to shew the number of volutions.

PORCELLIA MANITOBENSIS (page 318).

Figure 4. Side view of the most perfect specimen collected, from Pentamerus Point, Lake Manitoba.

Figure 4*a*. Dorsal view of the same.

EUNEMA SPECIOSUM (page 320).

Figure 5. Dorsal view of a gutta percha impression of a natural mould of the exterior of a shell of this species from one of the small islands in Dawson Bay. Natural size. By a typographical error, which escaped detection when the table of Errata on page 359 was prepared, it is stated in the text that "the largest example" of this shell, "when perfect, must have been fully ten inches in length." For "ten" read "two."

EUNEMA BREVISPIRA (page 320).

Figure 6. Dorsal view of a gutta percha impression of a natural mould, in dolomite, of the exterior of a shell of this species from Weston Point, Lake Winnipegosis.

Figure 7. Ventral aspect of a gutta percha impression of a similar mould of a specimen from Net Point, Lake Winnipegosis, shewing the shape of the aperture, &c.

EUNEMA SUBSPINOSUM (page 321).

Figure 8. Dorsal view of a gutta percha impression of a natural mould of the exterior of a shell of this species from Dawson Bay, at the first small point north of the mouth of the Red Deer River. Twice the natural size.

EUNEMA CLATHRATULUM (page 322).

Figure 9. Dorsal view of a gutta percha impression of a sharply defined mould of the exterior of an immature shell of this species from the western shore of Dawson Bay, at the mouth of the Red Deer River, six times the natural size.

ASTRALITES FIMBRIATUS (page 324).

Figure 10. Dorsal view of a gutta percha impression of a natural mould of the upper surface of a shell of this species from the southern shore of Dawson Bay, four miles west of Salt Point.

Figure 10*a*. Basal view of the only testiferous specimen collected, from the western shore of Dawson Bay, at the mouth of the Red Deer River.

Figure 11. Dorsal view, in outline, of a cast of the interior of the shell from the western shore of Dawson Bay, at the mouth of Steep Rock River.

Figure 11*a*. Basal view of the same, to shew the spiral groove which represents a corresponding fold upon the internal axis of the shell.

STRAPAROLLINA OBTUSA (page 328).

Figure 12. Dorsal view of a nearly perfect cast of the shell of a specimen of this species, from Pentamerus Point, Lake Manitoba.

Figure 12*a*. Basal view of the same.

Figure 13. Dorsal view of a gutta percha impression of a natural mould of the exterior of a shell of this species from the south end of Rowan Island, in Dawson Bay, to shew the surface ornamentation. Twice the natural size.

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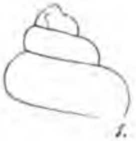
PLATE XLII.



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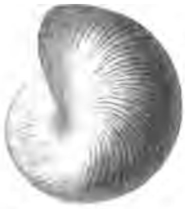

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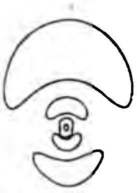

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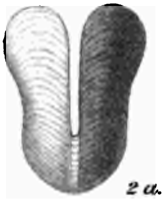

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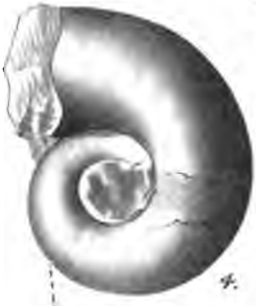

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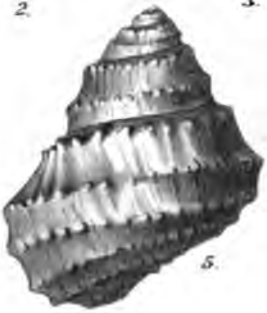

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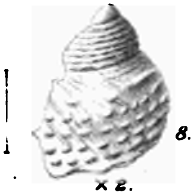

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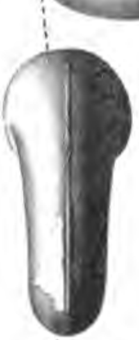

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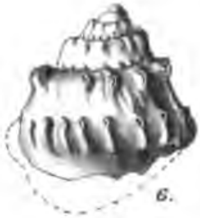

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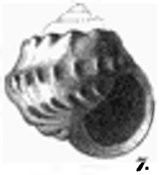

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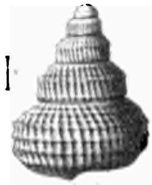

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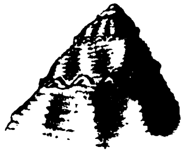

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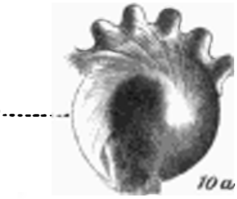

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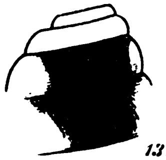

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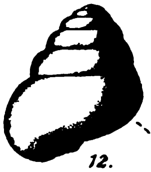

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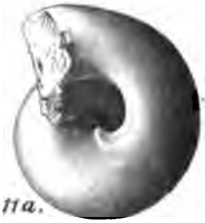

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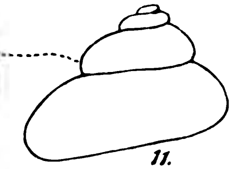

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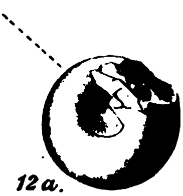

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PLATE XLIII.

Euomphalus (Straparollus) annulatus (page 324).

Figure 1. View of the upper surface of a specimen from Pentamerus Point, Lake Manitoba.
Figure 1*a*. A portion of the same enlarged.
Figure 2. Outline of transverse section of a specimen from a small island north north-west of Beardy Island, in Dawson Bay.

Euomphalus (Phanerotinus). Sp. Undt. (page 325).

Figure 3. View of the exposed portion of the specimen from a small island off Weston Point, Lake Winnipegosis, referred to in the text.
Figure 3*a*. Outline of transverse section of the same.

Euomphalus (circularis? var.) subtrigonalis (page 326).

Figure 4. Front view of a cast of the interior of a shell of this species from Snake Island, Lake Winnipegosis.

Omphalocirrus Manitobensis (page 327).

Figure 5. Diagrammatic representation of the upper side of the shell of this species, drawn from wax impressions of a number of natural moulds, in dolomite.
Figure 6. View of the lower surface of a specimen from Whiteaves Point, Dawson Bay, drawn from a wax impression of a mould of the exterior of the shell, in dolomite.
Figure 6*a*. View of the peripheral portion of the same.
Figure 7. Front view of a "loose" specimen from a small point three miles north of the mouth of Bell River, Dawson Bay, in outline only, drawn from a wax impression of a natural mould of the exterior of the shell.

Palæacmæa (?) cingulata (page 311).

Figure 8. Dorsal aspect of the most perfect specimen collected, from the western shore of Dawson Bay, at the mouth of the Red Deer River.
Figure 8*a*. Lateral view of the same.

Platyceras (Orthonychia) parvulum (page 331).

Figure 9. Side view of a specimen from one of the small islands in Dawson Bay.
Figure 10. Side view of a specimen from another small island in Dawson Bay.
Figure 11. Similar view of another specimen from the same locality as the last.

Platyostoma tumidum (page 331).

Figure 12. Dorsal view of the most perfect specimen collected, from Pentamerus Point, Lake Manitoba.

Pleurotomaria Spenceri (page 341).

Figure 13. Dorsal aspect of a small shell, supposed to be the young of this species, from Pentamerus Point, Lake Manitoba. Twice the natural size.

Naticopsis inornata (page 333).

Figure 14. Dorsal view of the type of this species, from a small island in Dawson Bay, north north-west of Beardy Island.

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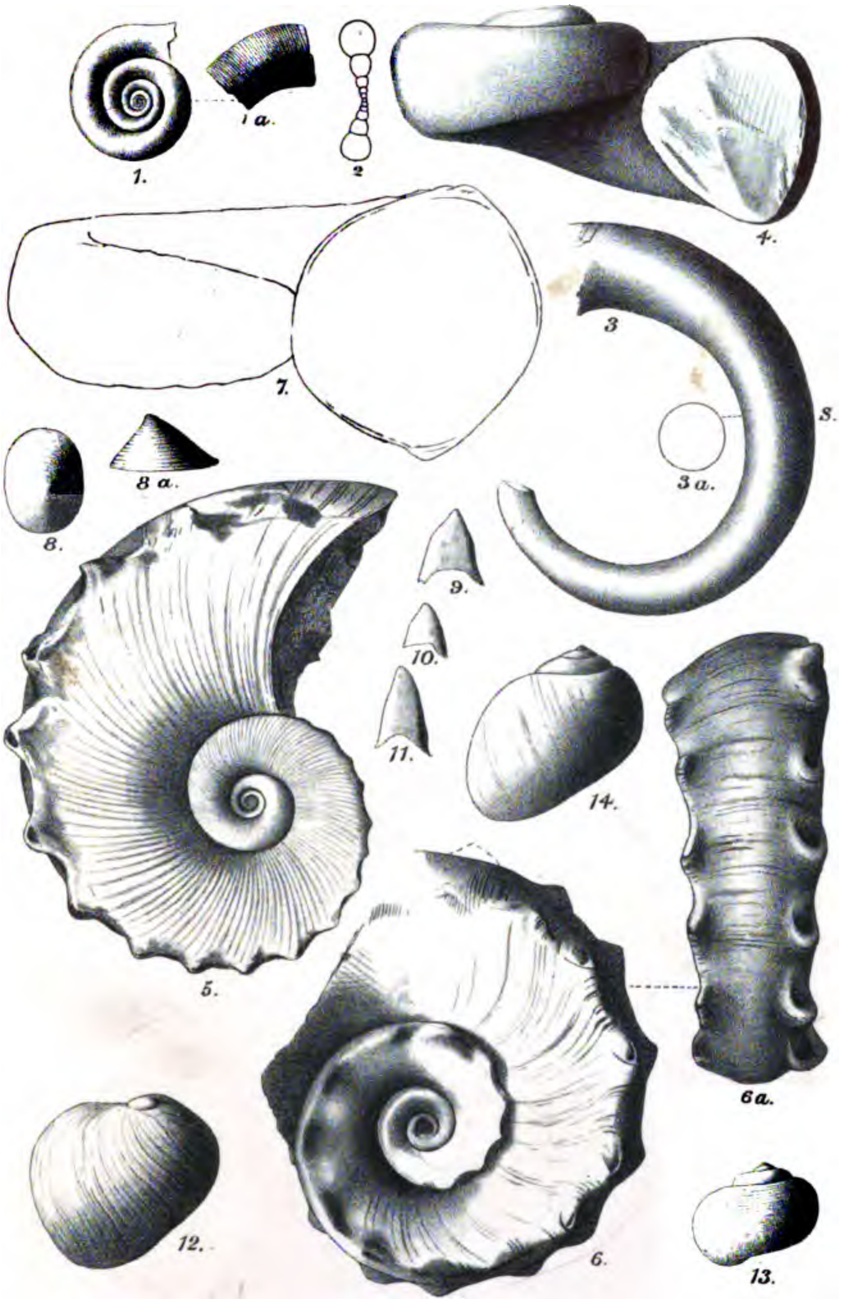


L.M. Lambe F.G.S. Delt

Mortimer, Lith

PLATE XLIV

PSEUDOPHORUS TECTIFORMIS (page 330).

Figure 1. Dorsal view of the type specimen, from Dawson Bay, two miles west of Salt Point.

Figure 1*a*. Basal view of the same.

LOXONEMA PRISCUM (page 335).

Figure 2. Dorsal view of one of the most perfect specimens collected, from Pentamerus Point, Lake Manitoba.

LOXONEMA CINGULATUM (page 336).

Figure 3. Diagrammatic representation of a shell of this species, based upon wax impressions of natural moulds of the exterior of two specimens, one shewing the whole of the spire, and the other the three latest volutions.

MACROCHILINA SUBCOSTATA (page 338).

Figure 4. Dorsal view of a specimen from Dawson Bay, at the mouth of the Red Deer River, in which the costulæ of the surface are unusually minute and nearly equal in size.

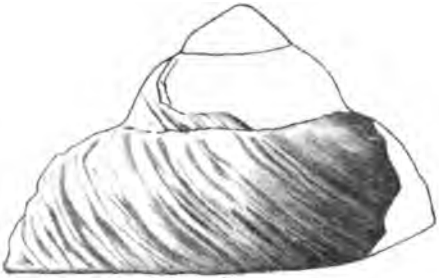
Figure 5. Dorsal view of a fragment from a small island in Dawson Bay, north of Salt Point, showing the typical sculpture of this species.

MACROCHILINA PULCHELLA (page 340).

Figure 6. Dorsal view of the most perfect specimen of this species yet collected, from the south-west shore of Dawson Bay, about two miles west of Salt Point. Twice the natural size.

Figure 6*a*. View of the ventral side of the same, to show the shape of the aperture. Twice the natural size.

PLATE XLIV.



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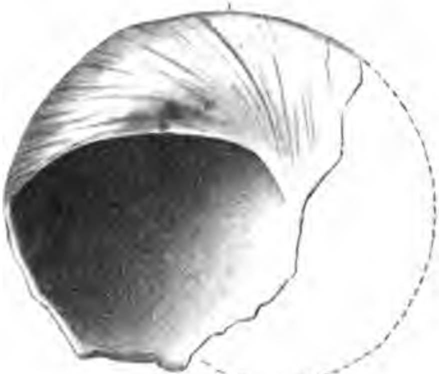

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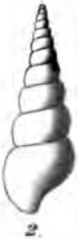

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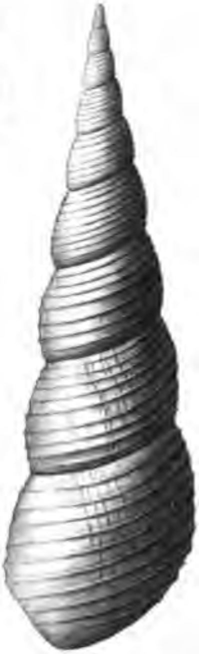

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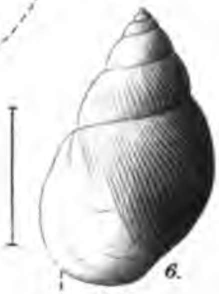

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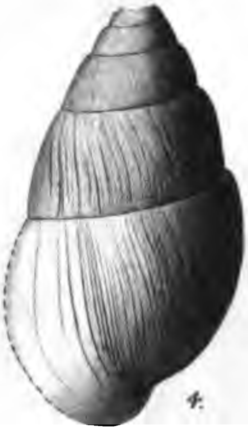

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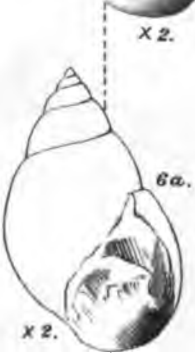

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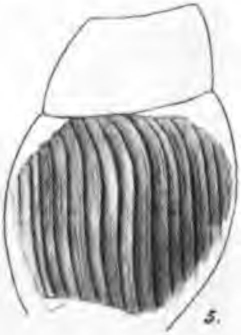

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PLATE XLV.

DENTALIUM. Sp. (page 311).

Figure 1. Side view of a specimen from Pentamerus Point, Lake Manitoba.

Figure 2. Similar view of a portion of a large specimen from Dawson Bay, Lake Winnipegosis.

MURCHISONIA TURBINATA, Var. (page 358).

Figure 3. Ventral view of the specimen referred to on page 315, under the name *M. Archiacana*, "in which the body whorl and two of the preceding volutions are preserved." Drawn from a wax impression of a natural mould of the exterior of the shell collected at an island in the southern portion of Dawson Bay.

BELLEROPHON PELOPS (page 317).

Figure 4. Dorsal view of a cast of the interior of the shell of a nearly adult example of this species, from Dawson Bay, at Whiteaves Point.

EUNEMA SUBSPINOSUM (page 321).

Figure 5. View of a gutta percha impression of a natural mould of the exterior of a shell of a specimen of this species from Dawson Bay, at a small exposure near Salt Point.

ASTRALITES FIMBRIATUS (pp. 323 and 324).

Figure 6. The wax impression of the natural mould referred to on page 323, showing the "regularly lobate or sinuate lateral expansion" at the periphery, as seen from above.

NATICOPSIS MANITOBENSIS (page 332).

Figure 7. Dorsal aspect of the most perfect specimen collected, from Pentamerus Point, Lake Manitoba. Twice the natural size.

LOXONEMA ALTIVOLVIS (page 335).

Figure 8. Dorsal view of a specimen from an exposure on Dawson Bay, half a mile north of the mouth of Bell River, which "has a considerable portion of the test preserved, on three contiguous volutions."

Figure 9. Ventral view of a cast of the interior of a shell of this species, from the south-west side of Cameron Bay, Lake Winnipegosis.

LOXONEMA GRACILLIMUM (page 337).

Figure 10. The gutta percha impression of a mould of the exterior of a shell of this species from Devils Point, Lake Winnipegosis, referred to on page 338. Four times the natural size.

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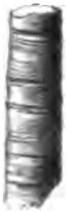
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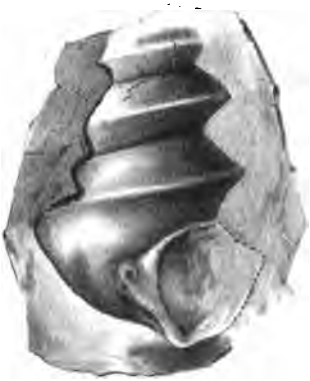
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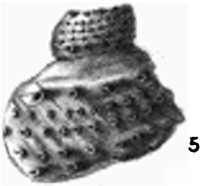
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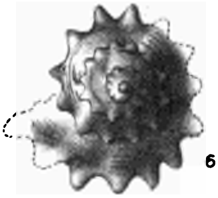
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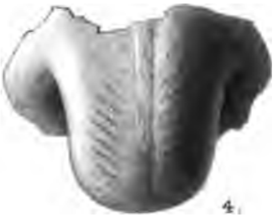
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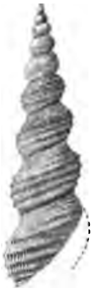
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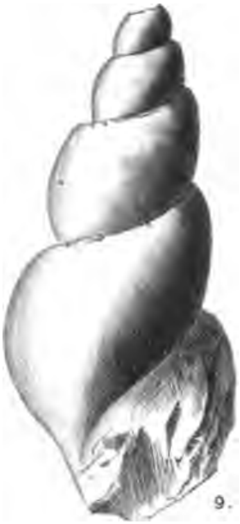
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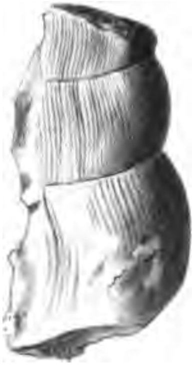
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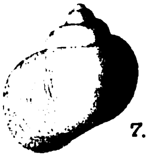
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PLATE XLVI.

PLEUROTOMARIA SPENCERI (page 341).

Figure 1. Upper surface of an immature specimen from an exposure at the mouth of the Red Deer River, in Dawson Bay, shewing the incremental striæ (somewhat diagrammatically) curving obliquely backward to the slit band. Drawn from a gutta percha impression of a mould of the exterior of the shell.

HYOLITHES ALATUS (page 342).

Figure 2. Side view of a cast of the interior of the shell, from South Manitou Island, Lake Winnipegosis.

Figure 3. Anterior moiety of another specimen from the same locality, "in which the central portion and one of the broad lateral wings of the dorsal surface are well exhibited, with the lines of growth and shape of the lip on that side."

Figure 4. Outline of transverse section of the shell of another specimen, from the western shore of Dawson Bay, north of Steep Rock River.

BRONTEUS MANITOBENSIS (page 347).

Figure 5. The specimen from a small island north of Whiteaves Point, Dawson Bay, referred to in the text as "Specimen No. 1."

Figure 6. The specimen from Pentamerus Point, Lake Manitoba, referred to in the text as "Specimen No. 3."

Figure 7. The specimen from Rowan Island, in Dawson Bay, referred to in the text as "Specimen No. 5."

LICHAS (TERATASPIS). N. Sp. (page 349).

Figure 8. Portion of the marginal spines of the pygidium from Rowan Island, Dawson Bay, referred to in the text. Drawn from a gutta percha impression of a natural mould, in dolomite, of the exterior of these spines.

CYPHASPIS BELLULA (page 349).

Figure 9. A cephalic shield of this species, from one of the small islands in Dawson Bay, as seen from above.

Figure 9*a*. Side view of the same, in outline, to shew the proportionate convexity.

PROETUS MUNDULUS (page 350).

Figure 10. Restoration of this species, in outline, as far as warranted by actual specimens. The characters of the genal angles of the cephalic shield, and those of the genal spines, if there were any, are unknown.

Figure 11. Glabella of a specimen, from a small island north of Whiteaves Point, Dawson Bay, twice the natural size, to shew the surface markings and glabellar furrows, as well as the occipital furrow and ring.

DINICHTHYS CANADENSIS (page 353).

Figure 12. View of the exterior of the only specimen collected, from Snake Island, Lake Winnipegosis, of the "premaxillary" tooth or dental plate of this species.

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PLATE XLVI.

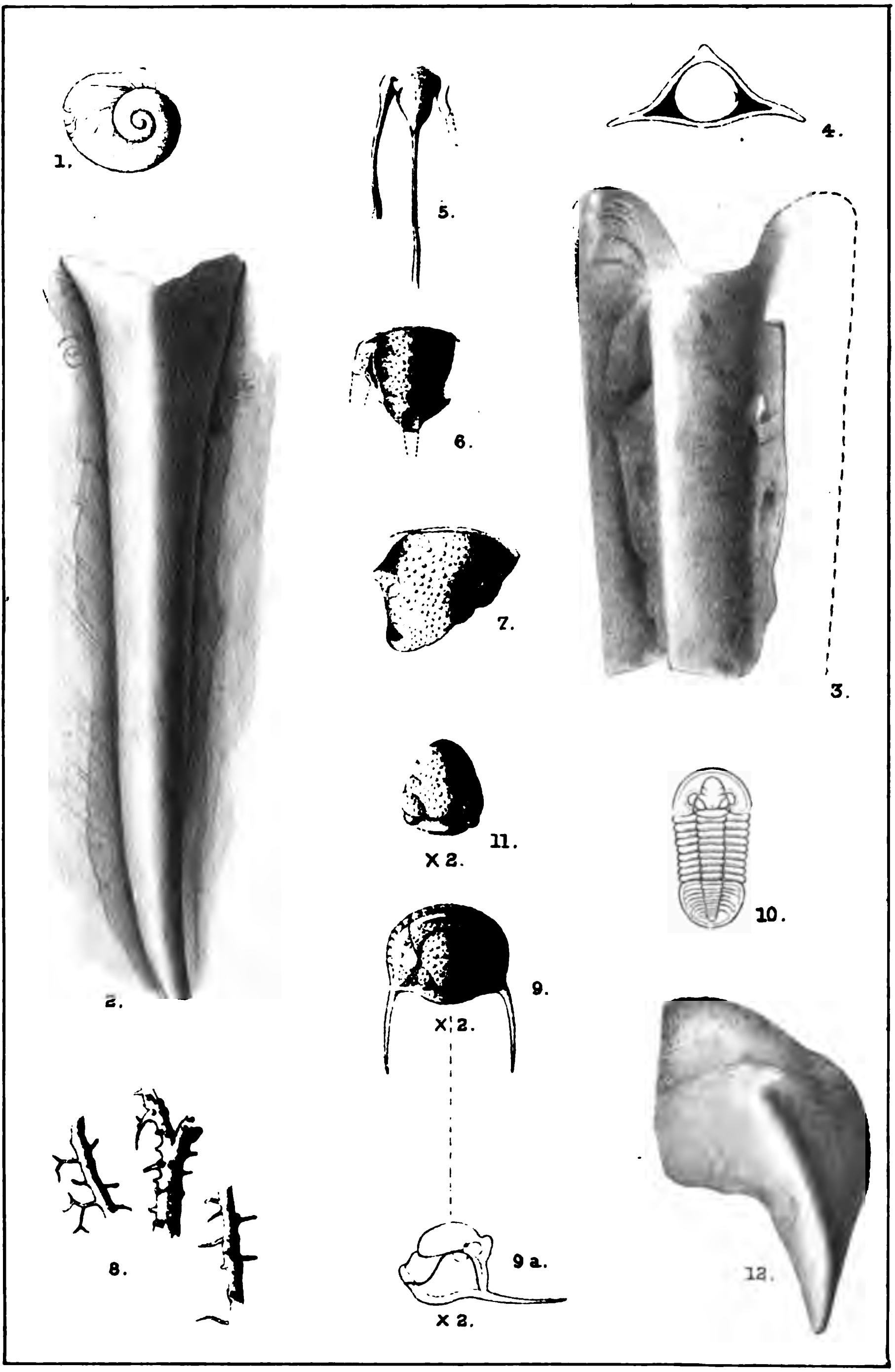

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PLATE XLVII.

ASPIDICHTHYS (?) NOTABILIS (page 354).

Figure 1. View of the outer surface of the supposed median ventral plate, from South Manitou Island, Lake Winnipegosis, upon which this species is based. One-half the natural size.

Figure 1*a*. A portion of the same, twice the natural size, to show the tuberculation of the surface more clearly.

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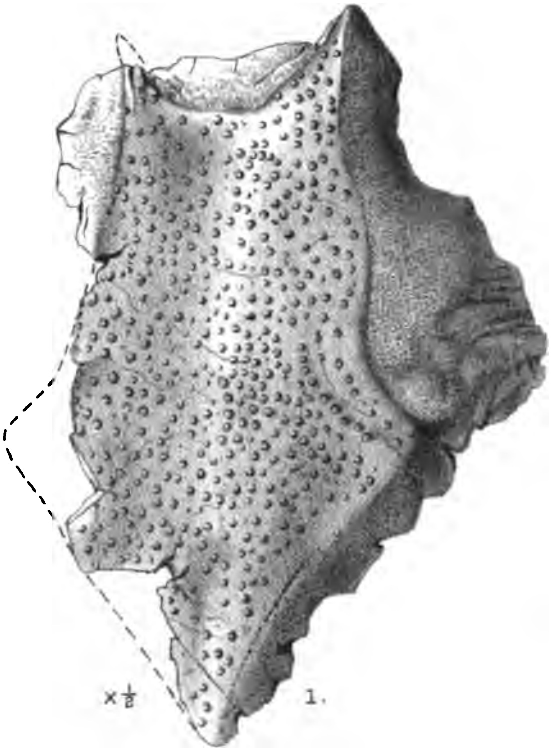
PLATE XLVII.



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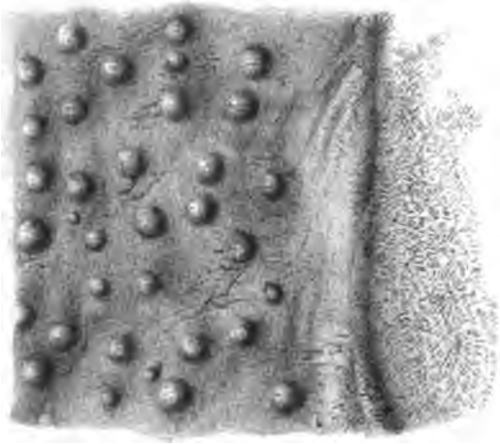

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PLATE XLVIII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

Monilopora antiqua (page 364).

Figure 1.	Specimen almost completely enveloping part of a crinoidal column.
Figure 2.	Partially attached specimen, with thin basal expansion and concentrically wrinkled epitheca.
Figure 3.	Portion of a free branch of another specimen.
Figure 3 *a*.	Small piece of the last, three times the natural size, to shew the surface ornamentation.

Ræmeria ramosa (page 367).

Figure 4.	Club-shaped terminal branch, or branchlet, of a specimen of this species.
Figure 5.	Compressed, fan-shaped, terminal branchlet of another specimen.

Dolatocrinus subaculeatus (page 369).

Figure 6.	Side view of the calyx of a specimen of this species.
Figure 6 *a*.	Basal view of the same calyx.
Figure 6 *b*.	Two arm bases of the same, four times the natural size, to shew the respiratory slit (R. S.) on one side of each.

Gennæocrinus Arkonensis (page 373).

Figure 7.	The specimen in the Museum of the Survey referred to on page 374.
Figure 7 *a*.	One of the primary interbrachials of this specimen, six times the natural size, to shew the faint surface markings.

Ancyrocrinus bulbosus (page 375).

Figure 8.	Specimen with the "lateral extensions" at different heights.
Figure 9.	Another specimen with the "lateral extensions" at nearly the same height.

Scalaripora Canadensis (page 378).

Figure 10.	The larger of the two type specimens from Thedford.
Figure 10 *a*.	Outline of transverse section of the same.
Figure 10 *b*.	Portion of the same, four times the natural size, to shew the apertures of the zoœcia.

Camarotoechia Thedfordensis (page 386).

Figure 11.	Dorsal view of a specimen from Thedford.
Figure 11 *a*.	The same, three times the natural size.
Figure 11 *b*.	Front view of the same specimen, three times the natural size.

Pleurotomaria Arkonensis (page 401).

Figure 12.	Apical side of the only testiferous specimen that the writer has seen.
Figure 12 *a*.	Lateral view of the same.

Orthoceras Arkonense (page 406).

Figure 13.	Side view of a cast of the interior of eight of the air chambers, shewing the comparative closeness of the four or five septa next to the body chamber and the distance apart of the posterior ones.
Figure 14.	Similar view of a cast of two air chambers and part of a third.
Figure 14 *a*.	Outline of transverse section of the same, shewing the relative position of the siphuncle.

Bactrites (obliqueseptatus? var.) Arkonense (page 407).

Figure 15.	A composite figure, the posterior portion being drawn from septate specimens, and the anterior from casts of the body chamber.
Figure 16.	Enlarged view of a cast of the interior of the posterior and septate end of the shell, which shews the ventral sinus distinctly on ten of the septa.
Figure 16 *a*.	Outline of transverse section of the same, also enlarged, and shewing the marginal and presumably ventral siphuncle.

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PLATE XLVIII.

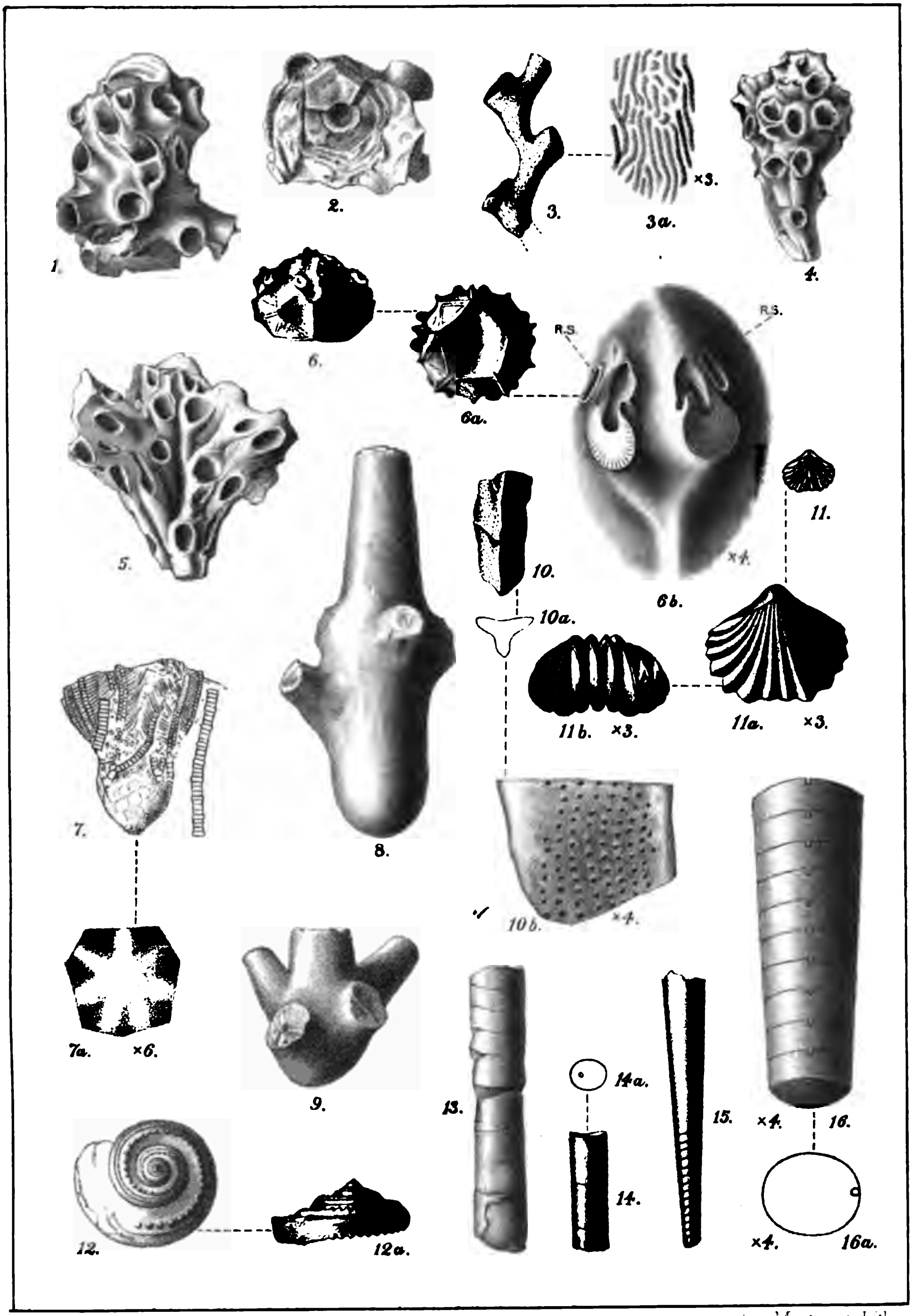

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PLATE XLIX.

ORTHOCERAS LAMBTONENSE (page 404).

Figure 1. Side view, in outline, of a cast of the interior of the shell of a specimen of this species, collected near Thedford by Mr. Kernahan and now in the Museum of the Survey.

Figure 1*a*. Outline of a transverse section of the same, shewing the almost central siphuncle.

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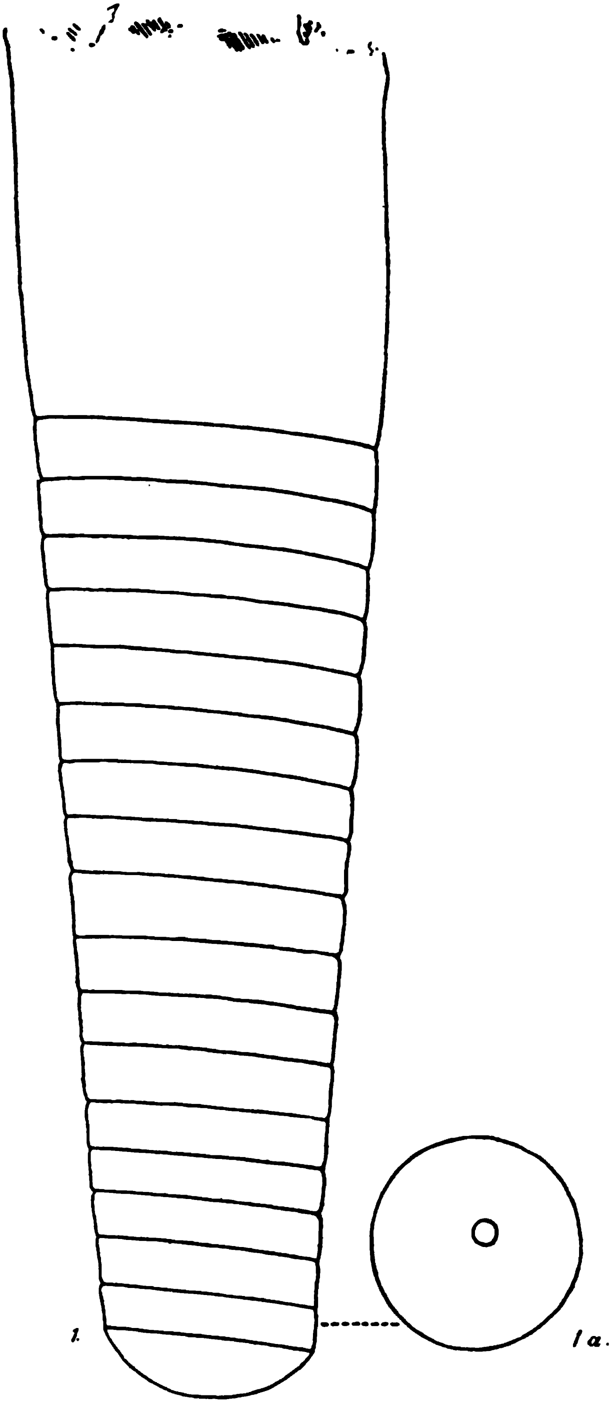

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PLATE L.

ASPIDICHTHYS NOTABILIS ? (page 411).

Figure 1. The specimen from Bartletts Mills collected by Mr. Kernahan.

Figure 2. The specimen from Bartletts Mills collected by Mr. Kearney.

PLATE (OR SCALE) GENUS AND SPECIES INDETERMINABLE (page 411).

Figure 3. The organic part of the specimen described under this heading, twice the natural size.

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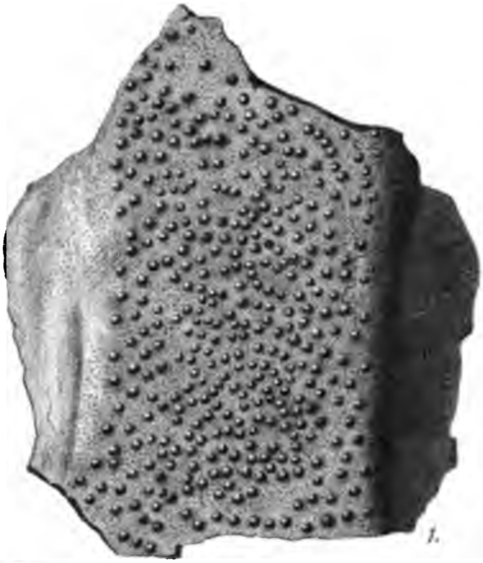
PLATE L



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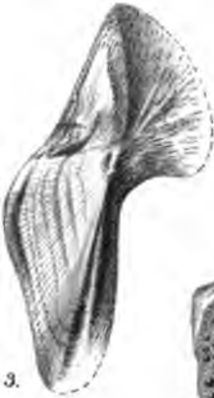

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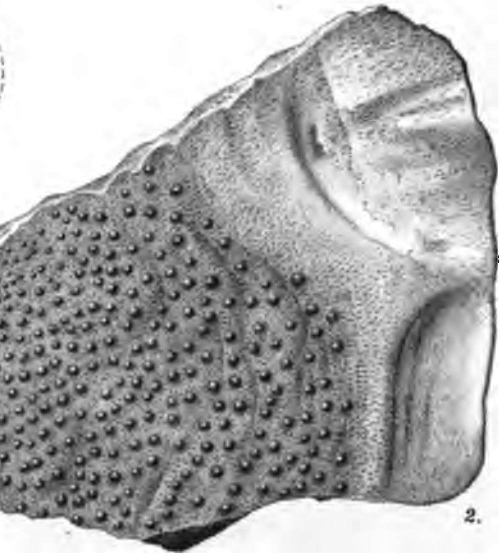

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L.M.Lambe F.G.S. Delᵗ.

Mortimer, Lith.

T. W.

From GEOLOGICAL SURVEY OF CANADA June 13, 97
GEORGE M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY

PART V.

7. On some additional or imperfectly understood fossils from the Hamilton formation of Ontario, with a revised list of the species therefrom

(WITH GENERAL TITLE PAGE, LETTER OF TRANSMITTAL, APPENDIX AND INDEX)

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